SEPTEMBER 1961

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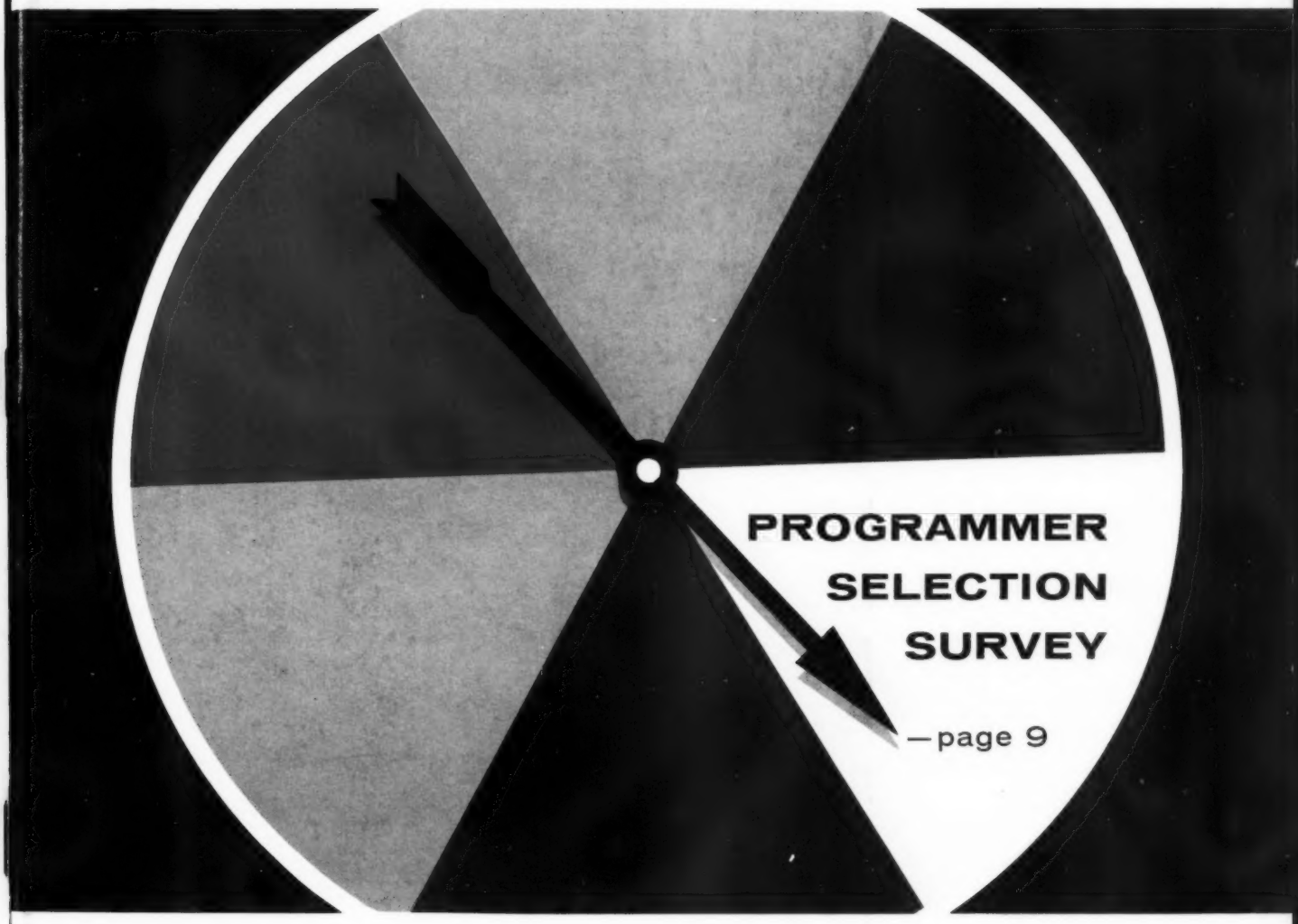

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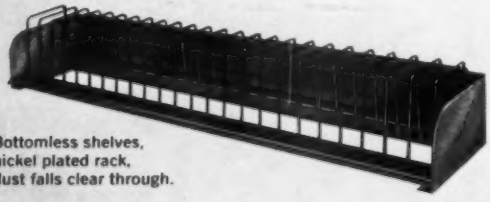

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OBSERVATIONS . . .
from the publisher

Round Table—Personnel Displacement

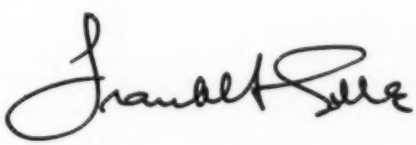
MUCH HAS BEEN WRITTEN and much more that could never see print spoken, on the effects of data processing on white collar employment. (We have isolated the white collar worker in this case because this is the limit of our area of activity, although we realize that the entire employment picture must be considered if we are to make an overall employment evaluation.)

We know that there have been some isolated cases of displaced office personnel due to adoption of latest data processing methods. In many more cases, we believe, problems have been avoided because enlightened management has given early consideration to the effects on personnel.

Now let the experts be heard. We have invited top authorities to attend a round table discussion late this month in Detroit, the birthplace of automation, to discuss this imperative question. Persons who will air their views include representatives of equipment manufacturers, industrial enterprises, utilities, the U. S. Labor Department, consultants and educational institutions.

Among the factors to be considered are the scope of the displacement problem, job opportunities, education and training considerations and areas of responsibility.

We have invited persons who have previously indicated strong feelings on the subject and a willingness to express them. A report of the session will be given in October DATA PROCESSING with interpretative editorial material to follow in subsequent issues.



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COMMENTS

Nice to hear

Phoenix, Arizona

Dear Sirs:

Your contributions to the data processing industry are many indeed. People have come to rely on *DATA PROCESSING* Magazine for timely and important news of data processing.

Walter E. Smithe, Jr.
Computer Department
General Electric Company

Computer census

Tulsa, Oklahoma

Dear Sirs:

I found your special feature "Computer Census" in the April, 1961 issue very interesting and informative. I recommend this be made a monthly feature.

James O. Reeves
Data Processing Department
Sinclair Oil & Gas Company

Compiling a computer census is a long-time research project, which would be an impracticality as a continuous monthly feature. In our News Summary, however, we do try to present all the new uses and users of computers of which we have learned during the period. Although this is not quite the same as a census, we feel our readers do have some interest in who is getting what kind of machines, and the uses planned for them. Editor. ■

AUTHORS

ROGER T. BIRINGER *(Port-A-Punching for Data Processing)* is manager of the statistical and tabulating department for Ortho Pharmaceutical Corporation, Raritan, New Jersey. He served in the U. S. Navy and participated in the officer training program during which he attended Princeton University, Bates College and Dartmouth College. He received his B. S. in business and M. A. in personnel and guidance from Seton Hall University. He is presently director of the NAA, Raritan Chapter.

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NEWS SUMMARY

Bell Telephone Laboratories uses an IBM 7090 to index documents according to significant title words.

Battelle Memorial Institute used its IBM 650 to simulate a reading device in researching a reading device for the blind.

American Medical Research Foundation, in cooperation with Univac division of Sperry Rand, is using a Solid State to evaluate medical data in striving to reduce newborn deaths.

Michigan Hospital Service is buying the DATAmatic 1000 it has been renting for the past three years and will have all records covering 3 1/2 million members on by end of 1961.

ACM is forming a national committee for business data processing for those members primarily interested in this aspect. The fields of interest include business theory, operations research, management gaming, simulation and forecasting techniques, as well as applications.

The International Organization for Standardization Technical Committee 95 met in Turin, Italy, in June to further standardization of office machines internationally.

BANKING

Philadelphia National converts installment payment processing on a Cummins ODP Reader, which reads coupons to produce punched cards.

New Jersey Bank and Trust is using an NCR 310 and sorters for check handling speedup.

Meadow Brook National Bank in West Hempstead, N. Y. has retired two experimental fluorescent dot check sorters which they have used since Burroughs installed them in 1957 as a field test.

Federal Reserve Bank of San Francisco has installed a National Data Processing Document Processing System for check processing; this is one of five FR banks to try various hardware for the job.

EXPANSIONS

Autonetics division of North American Aviation has transferred its computer and data system operations to its new building in Anaheim.

C-E-I-R's newest merger is with American Research Bureau, Inc.

Federal Electric Corporation will provide nationwide service for Clary computers.

Collins Radio Company has a new regional office for sale of microwave communications systems at Dallas and has completed a move to its new research center at Newport Beach, Calif.

Dashew Business Machines has acquired Automated Sensory Devices. The firm will be known as Electronic Datacoupler, Inc., a subsidiary of Dashew.

Control Data is expanding all over: new government relations offices were opened in Washington, D. C.; newest coast regional offices opened in Los Angeles; new east coast regional headquarters were established at Newark; and contracts have been awarded for new corporate headquarters and computer division at Bloomington.

Datex Corporation is planning the first unit of its new building at Monrovia.

Electronic Engineering Company of California has appointed the R. R. Thomas Company, Dallas, as its southwestern representative.

Farrington is producing optical scanners at the rate of one a week on its new production line.

Jonker Business Machines is setting up a nationwide network of offices for sale and service of information retrieval systems.

National Cash Register Company is planning two service training centers, one in Denver, the other in Hartford, Conn.

RCA has opened a government marketing office at Dayton, Ohio, for government computer customers.

Data Systems division of Telex, Inc. has acquired Inteledata Corporation and is going into high speed printers for computers.

United Research Incorporated of Cambridge, Mass. acquired Broadview Research Corporation of the west coast.

FINANCIAL

Robertson Photo-Mechanix reports sales up 25 percent for the first six months of 1961.

Litton Industries declared a 2 1/2 percent common stock dividend, to be paid in October to stockholders on record as of October 6, 1961. Litton's total sales for the first nine months of present fiscal year increased 23 percent; net earnings were $6,821,000, an increase of 25 percent.

Digitronics reports record highs in sales and profits with 142 percent sales increase to $1,988,000; profits up 190 percent, average 25.5 cents a share.

EDUCATIONAL

Royal McBee Corporation and Staples High School of Westport, Conn. formed a cooperative venture to teach high school students techniques of programming and operating an electronic computer. This pioneer program is aimed at testing abilities of high schoolers to grasp fundamentals of electronic computation and to provide valuable information on instruction in this field at the high school level.

IBM Education Center, New York, had more than 200 customer students (the largest class in its 11 year history) in computer technology.

Philco Computer Center at Willow Grove, Penn. holds one day seminars for executives and management personnel; these are scheduled for September 6, 9; October 10, 24; November 2, 21; and December 5, 19.

SERVICE CENTERS

Burroughs Corporation opened the country's first MICR consultation center at Chicago.

Central Information Bureau, Inc., White Plains, New York, announced the nation's first data processing service for the employment field.

NEW USES AND USERS

Auto Owners Insurance Company, Lansing, Mich., installed a voice-data communications network to link the home office with five outstate branches.

The Atlantic Refining Company, Philadelphia, has a new computing center with IBM 7070-1401 and 704 computer systems.

Celanese Corporation of America uses a Honeywell control system for its new celanese acetyl plant under an H 290 computer.

Delta Air Lines is the second to order a Sabre reservation system (IBM 9074) for almost instant reservation data; the system will consist of two IBM 7074 computers and 300 inquiry stations at agent stations about the country.

The Detroit Stock Exchange is using SBC's IBM 650 facilities for accounting records on stock trading for its new clearing corporation.

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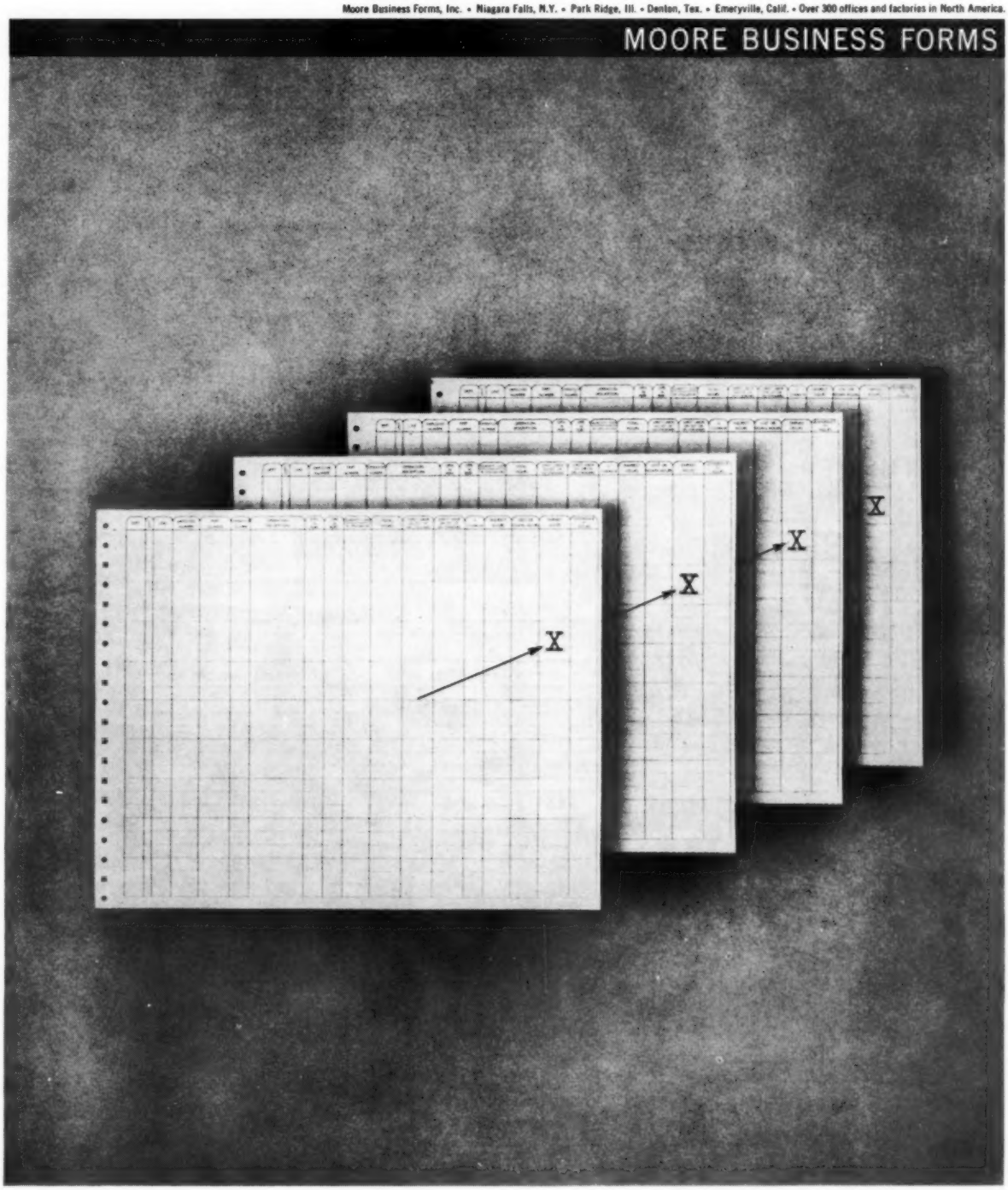

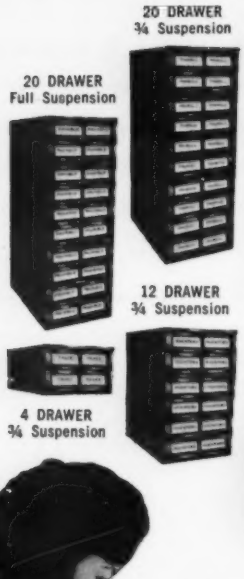

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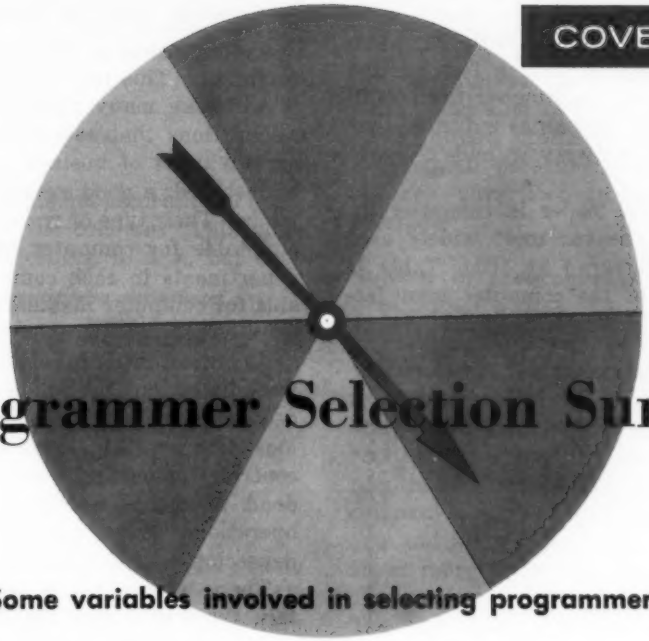
COVER FEATURE

Programmer Selection Survey



Some variables involved in selecting programmers

By John Watson

MOST COMPUTERS are of little value unless a competent staff is available to operate them. Selecting these individuals is a major problem for any company, no matter its size. The following survey, incorporated into my master's thesis, was conducted during the early part of 1961. It was carried out to determine some of the variables involved in selecting programmers. The survey was conducted by mail, with questionnaires being sent to 262 companies located throughout the United States and Canada. These companies were chosen from articles written about them in automation magazines, data processing magazines, American Management Association publications, personal contacts, lists of computer users and other sources.

Recipients were requested to complete the questionnaire and return it in an enclosed self-addressed envelope at their earliest convenience. Returns were received from 52.3 percent of all companies to which questionnaires were sent. As in every survey, not all questions were answered by every respondent. In the tables that follow, the number of companies answering is usually shown.

Type and number installed

As Table I relates, the most widely used computer was IBM's 650. There were over three times as many 650's installed as its closest rival. Twenty-one companies indicated they had one 650 installed, and 19 companies indicated they had two or more 650's.

Table I. Model and number of computers installed

Model number	Quantity	Model number	Quantity
IBM 650	118	IBM 7090	3
IBM 705	35	IBM 701	2
IBM 305	16	NCR 304	2
IBM 1401	13	Telefile	2
Burroughs 205	11	IBM 702	1
Burroughs 220	10	Univac 1103A	1
IBM 7070	8	RCA 301	1
RCA 501	8	RCA 601	1
Univac I	7	Burroughs E101	1
IBM 704	6	Burroughs 204	1
Bendix G-15	5	Datatron 205	1
LGP 30	5	AM 942	1
Univac II	4	Recomp II	1
Univac Model 0	4	Readix	1
Univac 90	4	Pace Analog	1
Univac 60	3	Honeywell 800	1
Univac 80	3		
Univac 120	3	Total	284

(continued on next page)

It is interesting to note that the fourth most widely used computer was IBM's 1401. Although this computer was marketed only a few months prior to the survey, it will outnumber the 650 in a few years. Many of the companies indicated that a 1401 was on order for delivery in mid- or early 1961.

IBM was definitely the leader in computer installations. Six out of the ten most widely used computers were manufactured by IBM. Table II presents a breakdown of the computer manufacturers.

Table II. Computer manufacturers and total installations

Manufacturer	Total	Percent
IBM	202	71.1
Remington Rand	29	10.2
Burroughs	24	8.4
RCA	10	3.5
Bendix	5	1.7
Royal Precision	5	1.7
National Cash Register	2	.7
Teleregister Corp.	2	.7
Autonetics	1	.4
Readix Corp.	1	.4
Minneapolis Honeywell	1	.4
Addressograph-Multigraph	1	.4
Electronic Associates	1	.4
Total	284	100.0

Applications used on computer(s)

A wide range of applications were used on the computers. This is a broad subject, of course, and it will take many years before we know all the applications that can be used on a computer. In certain types of businesses more applications can be installed; a good example is the insurance companies. Their type of work is repetitive and readily adaptable for computer application. Also, certain departments in each company are especially suitable for computer installation. Payroll applications were common to most replies.

As mentioned previously, many applications were listed, but the following are the major uses: accounting (with billing operations mentioned most frequently), inventory control, production control, forecasting, scientific applications, dividend payments, statistical operations, personnel operations, sales analysis, management reports, depreciation accounting, W-2 forms and others.

There were many applications peculiar to certain types of companies. Examples of these are: mortgage loans, auto policies, distribution of premiums and actuarial studies for insurance

QUESTIONNAIRE

1. Make and model number of computer (s)_____

2. Number of computers installed_____

3. Applications used on computer (s)_____

4. Estimated number of employees in company (division).
   ☐ 100-500 ☐ 1001-5000 ☐ 10,001-15,000
   ☐ 501-1000 ☐ 5001-10,000 ☐ 15,001-20,000

5. Briefly describe your computer programmer recruitment program.

6. Number of programmers for each computer_____

7. Explain the background (mathematics, accounting, engineering, etc.) required for the programmers of each computer.

8. What are your minimum educational requirements for programmers?
   ☐ High School ☐ College (Bachelor's Degree)
   ☐ Business School ☐ College (Master's Degree)
   ☐ Junior College ☐ College (Doctor's Degree)
   ☐ College (with no degree)

9. From what source do you select each type of programmers?
   Model Number_____
   ☐ Experience with your company but no computer experience.
   ☐ Experience with a company similar to yours but no computer experience.
   ☐ Experience with your company as a tab operator.
   ☐ Someone outside the company with computer experience.
   ☐ Someone outside the company with no computer experience.
   ☐ Other (specify)_____

10. Do you use testing techniques as an aid for selecting your programmers?
    ☐ Yes ☐ No

QUESTIONNAIRE CONTINUED

11. Which type (s) of tests do you use?
    Verbal ability test
    Arithmetical reasoning test
    Abstract reading test
    Other (specify)_____

12. What is your opinion of the results obtained from your current programmer recruiting and selection program?

13. Average age of newly hired programmers.
    ☐ 17-20 ☐ 26-30 ☐ 36-40
    ☐ 21-25 ☐ 31-35 ☐ over 40

14. Estimated average annual starting salary for programmers.
    ☐ Under $4000 ☐ $10,001-$12,000
    ☐ $4001-$6000 ☐ $12,001-$14,000
    ☐ $6001-$8000 ☐ $14,001-$16,000
    ☐ $8001-$10,000 ☐ Above $16,000

15. Comments_____

16. If you wish a copy of the results of the survey, please fill in your name and address below.
    Name_____
    Address_____

companies; installment loan accounting, demand deposit accounting and mortgage accounting for banks; freight statistics, mail movements and car movements for railroads.

Estimated number of employees in company (division)

Table III lists the respondents according to number of employees within the company. This table lists the respondents according to size, but does not imply that more companies employing 1,001 to 5,000 individuals install more computers. Table IV lists the company size and number of computers installed.

Table III. Size of companies returning questionnaires

Number of employees in company	Number of companies within the range
Under 100	1
100-500	12
501-1,000	10
1,001-5,000	29
5,001-10,000	21
10,001-15,000	18
15,001-20,000	12
Over 20,000	14
Total	117

Table IV. Company size and number of computers installed

Company size	Number of computers
Under 100	4
100-500	37
501-1,000	10
1,001-5,000	46
5,001-10,000	31
10,001-15,000	75
15,001-20,000	21
Over 20,000	63
Total	287

Computer programmer recruitment program

Most respondents had a recruitment program; six companies that replied had no formal program. The most widely used recruitment program was promotion from within: 76 companies indicated they followed this program. Several departments in particular promoted individuals to programmers — accounting, data processing, and systems and procedures. By following this program, companies presented better promotional opportunities for employees and were assured that the programmers had a knowledge of the company's operations and of the company organization.

Another program being followed was recruitment of individuals at colleges and universities. Thirty companies indicated they recruited from this source.

Eighteen companies indicated they placed help wanted ads in newspapers, but most of these respondents were looking for experienced programmers. Some companies indicated they recruited through employment agencies, personal contacts, individuals applying for jobs, bidding by employees (union contract requirement), or help wanted ads placed in technical journals.

Many companies used more than one source for recruitment. Some companies promoted from within and also recruited at colleges and universities; others promoted from within but wanted experienced personnel to offset the new people, so they advertised in newspapers or technical journals.

Number of programmers for each computer

The total number of programmers varied considerably; the range was from one to 100 programmers. No specific number can be considered the correct number, but there are some general statements that may be made on the basis of the replies. The companies using IBM's 650 computer required relatively few programmers. Of these companies, 82 percent indicated they use between one and six programmers, with 9 percent using 15 or more programmers. The maximum number of programmers used on the 650 was twenty-four. The second most widely used computer, IBM's 705, was just the opposite of the 650. Of the companies using this computer, 7 percent employed between one and six programmers, with 83 percent employing 15 or more programmers. The maximum number of programmers used on this computer was 48.

IBM's 305 computer required very few programmers. Of the 16 companies using this computer, two companies employed one programmer, eight companies employed two programmers, four companies employed three programmers, and two companies employed five programmers. IBM's 1401 computer falls into this same category; 75 percent of the companies using this computer employed one to six programmers.

All the Burrough's 205 installations employed between one and six programmers. The Burrough's 220 installations had similar requirements, with the exception of one company which employed ten programmers.

Of the companies using IBM's 7070 computer, 17 percent employed between one and six programmers, while 83 percent employed between eight and 15 programmers. Companies using RCA's 501 computer employed between six and eight programmers. There seemed to be no set pattern for the companies using the UNIVAC I computer, except that most of the companies employed six or more programmers.

All companies using IBM's 704 computer employed 15 or more programmers. The maximum number of programmers was 30. Companies using Bendix's G-15 computer employed six or less programmers. The same is true of the companies using the LGP-30 computer. Companies using the UNIVAC II computer employed more than 15

programmers, with a range of 20 to 25 programmers. The other computers were not used by enough companies to determine any trends.

After studying the results of this question, the following general conclusion was resolved: More programmers are required as the size of the computer increases.

A study was made to see if there was any correlation between company size (number of employees) and the number of programmers employed. The result disclosed no correlation between the number of employees and the number of programmers.

Background required — mathematics, accounting, engineering, etc.

Table V lists the background required of the programmers. In many cases a company reported more than one type of background was required.

Table V. Background required for programmers

Background	Number of companies	Percent
Mathematics	72	61
Accounting	52	44
Engineering	29	25
Business administration	18	15
No requirements	13	11
Logical ability	12	10
Tabulating experience	12	10
Experience in company	10	9
Systems	6	5
Physics	5	4
Liberal arts	3	3
Science	3	3
Statistics	3	3
Economics	2	2
Miscellaneous	2	2

Minimum educational requirements for programmers

As Table VI relates, approximately the same number of companies have a minimum educational requirement of high school as opposed to those with a minimum requirement of a bachelor's degree.

Table VI. Minimum educational requirements

Educational requirements	Number of companies	Percent
College (bachelor's)	53	42.0
High school	48	38.2
College (no degree)	11	8.9
No requirements	6	4.7
Business school	4	3.1
Junior college	4	3.1
College (doctor's)	—	—
College (master's)	—	—
Total	126	100.0

Source for each type of programmer

Table VII. Sources for selecting programmers

Source	Number of companies	Percent
Experience with your company but no computer experience	99	85
Experience with a company similar to yours but no computer experience	11	9
Experience with your company as a tab operator	64	55
Someone outside the company with computer experience	53	45
Someone outside the company with no-computer experience	36	31
College	9	8

Table VII presents the sources for selecting programmers. Many companies indicated they used several sources for selecting their programmers. The most prominent source was within the company; 85 percent of the respondents promoted individuals within the company to programmers. The second highest source was also promotion from within; 55 percent of the respondents indicated they promoted those individuals that had data processing experience with the company.

An analysis was made to determine the number of companies promoting from within and also selecting individuals outside the company with or without computer experience. This analysis indicated that over 50 percent of the respondents used more than one source for selecting programmers, with the majority favoring promotion from within and selection of individuals outside the company with computer experience.

Testing techniques used

A majority of the respondents indicated they use some type of testing technique to help select their programmers. Although this was not the final criterion, it helped in selecting these individuals. Ninety-six respondents (82 percent) indicated they used testing techniques, and 21 companies (18 percent) indicated they did not use testing techniques. Of the companies not using testing techniques, 11 of them (52 percent) indicated their average age of newly hired programmers to be in the 21 to 25 age bracket.

Type of tests

There were various types of tests used by the respondents. Table VIII lists the replies to this question.

Table VIII. Type of tests used as an aid in selecting programmers

Type of test	Number of companies
Arithmetical Reasoning Test	54
IBM Aptitude Test	43
Verbal Ability Test	25
Abstract Reading Test (1)	17
Abstract Reasoning Test	6
General Aptitude Tests	2
LOMA (Life Office Management Association)	2
AVA (Personality-temperament test)	2
Wonderlic Personnel Test	1
Number Comparison Test	1
Name Comparison Test	1
Pattern Perception Test	1
Flow Chart Test	1
Federal Civil Service Entrance Exam	1
General Intelligence Test	1
Spatial Relations Test	1
California Test of Mental Maturity	1
Integrative Ability Test	1
EDP Thurstone Test	1
General IQ Test	1
EDP Manhattan Test	1
Stanford Scientific Aptitude Test	1
Logic Test	1
Watson-Glacer Test	1
Clerical Aptitude Test	1
General Learning Ability Test	1
Reasoning Ability Test	1
Interest Inventory Test	1
Conceptual Ability Test	1

Recruitment results

Most respondents were satisfied with their current recruiting and selection program. Eighty-six percent were satisfied with the program; this included those respondents with excellent programs to those with average programs. There were only seven companies dissatisfied with their current program.

Average age of newly hired programmers

Table IX lists the age of the newly hired programmers. Most programmers were hired during their twenties; 86.8 percent were hired between the ages of 21 to 30.

Table IX. Average age of newly hired programmers

Age bracket	Number	Percent
17 - 20	0	—
21 - 25	44	41.5
26 - 30	48	45.3
31 - 35	11	10.4
36 - 40	2	1.9
Over 40	1	.9
Total	106	100.0

Average annual starting salary for programmers

The questionnaire replies in this area are of special interest to those individuals who contemplate a programming career. Table X presents the response to this question.

Table X. Salary range of newly hired programmers

Salary range	Number	Percent
Under $4,000	0	—
$ 4,001 - $ 6,000	44	38.9
$ 6,001 - $ 8,000	60	53.1
$ 8,001 - $10,000	9	8.0
$10,001 - $12,000	0	—
$12,001 - $14,000	0	—
$14,001 - $16,000	0	—
Above $16,000	0	—
Total	113	100.0

The table indicates that only three salary ranges were used, with the range of $6,001 to $8,000 being the most popular. This indicates only a trend in the wage scale, it does not reveal anything definite. When a company checked off the $6,001 to $8,000 range, it could be paying $6,001 a year or it could be paying $8,000. There was a wide salary range in each level. But we can arrive at some definite trends.

Table X by itself is meaningless, there are other factors which must be considered. Table X is a general table listing the wage scales. But what about the type of background required by each company? Does this have an effect on the results? Table XI distributes the salary ranges into the minimum educational requirement categories.

A study was made to determine if company size had a bearing on the wage scale, however, there appeared to be no definite trend indicating this.

Another important consideration is the age bracket of the programmers. There was indication that salary increases with an increase in age. In the 21 to 25 age bracket, 57 percent of the programmers were paid between $4,001 and $6,000, whereas, in the 26 to 30 age bracket, 61 percent of the programmers were in the $6,001 to $8,000 bracket.

A belief is somewhat prevalent that in certain areas of the country programmers receive higher wages. The results of the study, however, reveal that this notion is not authentic. Each state paid approximately similar starting salaries.

Table XI. Salary ranges for minimum educational requirements

Educational Requirements	Salary ranges $4,001 - $6,000	$6,001 - $8,000	$8,001 - $10,000
High school	26	18	3
Business school	1	1	—
Junior college	—	2	—
College (no degree)	3	6	1
College (bachelor's)	11	27	1
Total	41	54	5

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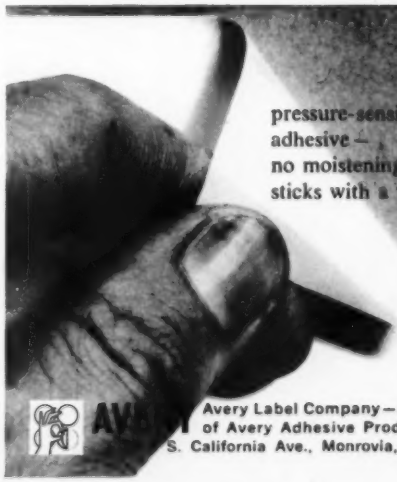

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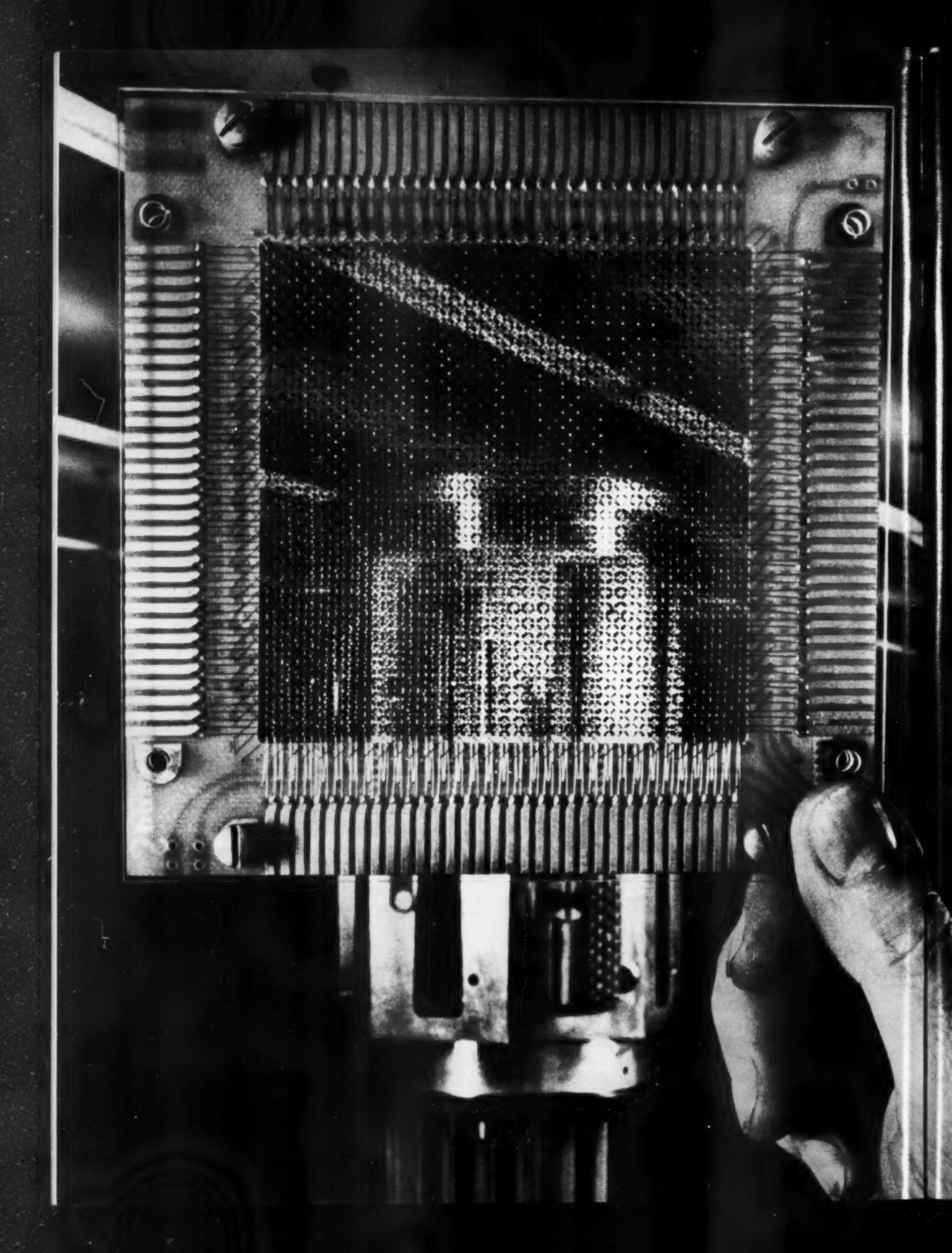

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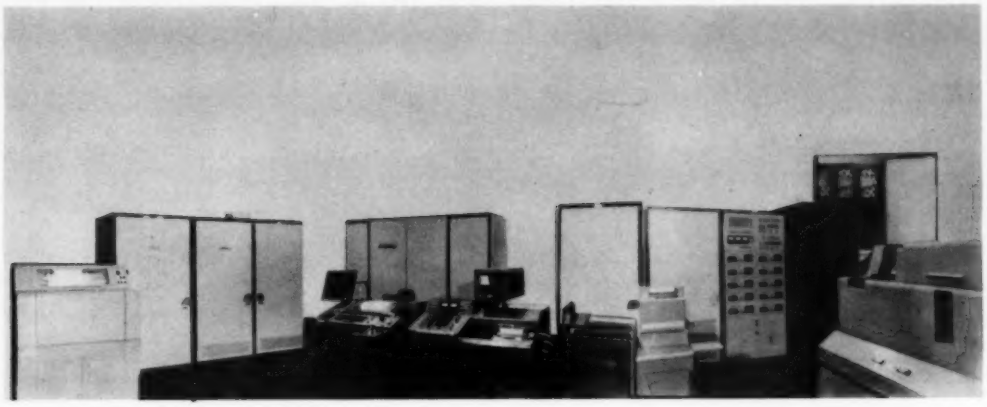


NEAC - 2203 (JEIDAC - 101)

日本電子工業振興協会

Japanese Computers

Japanese inventors have added several new ideas to computers.

By Isao Takasaki

THE HISTORY OF COMPUTERS IN JAPAN closely parallels the pattern set in England, the United States, and other countries, in that our first efforts took place in the laboratories of our universities and in public research institutes. While the first Japanese relay computer, the ETL-Mark I, was not put into operation until December, 1952 (eight years after the Mark I computer at Harvard University), Japan is now producing a number of commercial computers with solid-state circuitry. Our computers will make increasing use of printed circuit construction and transistors.

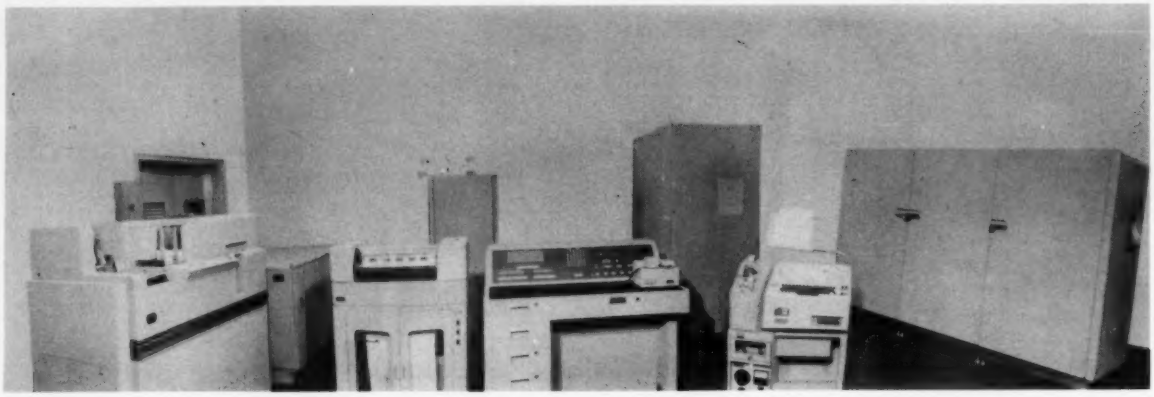
The fundamental theory of the parametron — a memory circuit device unique to Japan — was developed in 1952 by Dr. H. Takahashi and Dr. E. Goto at Tokyo University. A number of parametron computers have been produced by several commercial manufacturers and are currently in use. Another device contributed by Japan is the Esaki diode, invented by Dr. Leo Esaki in 1957. It is a highly insulated germanium diode containing a special negative resistance region. These two inventions, along with others, are indicative of Japan's progress in the development of computers.

As of March, 1961, the four major Japanese computer manufacturers — Fuji Communication Apparatus Manufacturing Co., Ltd. (FACOM); Hitachi, Ltd. (HITAC); Nippon Electric Co., Ltd. (NEAC); and Tokyo Shibaura Electric Co., Ltd. (TOSBAC) — had installed 53 general purpose computing systems, including 17 different models, in customer organizations. Other companies are active in the production of special purpose and scientific computers, input and output devices, converters, and communications equipment. Much of the input-output equipment used with present-day Japanese computers is manufactured by the International Business Machines Corporation and Remington Rand Univac.

Four of these general purpose computers are located at the Japan Electronic Industry Development Association (JEIDA) in Tokyo: a NEAC 2203 and a HITAC 301, which are medium sized, transistorized, magnetic drum machines; and a FACOM 212 and TOSBAC 2103, both small sized machines. Organized in April, 1958, and sponsored by 66 manufacturing concerns, JEIDA will assist in the development and production of new electronic products, especially electronic computers. JEIDA's main facility is its Digital Computer Center, which offers the following services:

1. Testing reliability and other operating factors of digital computers.
2. Development of program sub-routines.
3. Development of new programming systems.
4. Systems analysis and data processing consulting.
5. Analyst and programmer training.
6. Computation service.
7. Centralized technical and sales information service for domestic Japanese computers.

(continued on next page)



HITAC - 301 (JEIDAC - 102)

During a testing period from July, 1959, to August, 1960, the four machines at JEIDA averaged 90 to 95 percent good time for 300 to 350 hours operation per month per machine. Among the programs written at JEIDA are the following routines.

1. Response function of an optical lens system.
2. Flight plan calculation for a DC-8 jet airliner.
3. Arbitration of city gas demand.
4. Design of a multistage precision distillation tower.

Using its own computer systems, Japan has been solving applications and systems problems similar to those encountered in other countries. Here are some examples.

Seat reservation system

Japan National Railways, using a (MARS-1) system (Magnetic—electronic Automatic Reservation System), and Kintetsu Private Railways, with a NEAC 2404, have installed inquiry and reservation systems for passenger express trains, using remote agent sets and teletype (MARS-1) and microwave (NEAC 2404) communications hookups to the central computers.

Automatic message accounting system

The expansion of toll dial system areas brought about a need for such a system, which could record for each call the date and answer time, calling office, and subscriber rate and chargeable time; calculate total charges per call and for a billing period; and produce a bill. A system using parametron circuitry has been developed by the Japan Telegraph and Telephone Public Corporation, and has been undergoing field testing since early 1959.

Character recognition

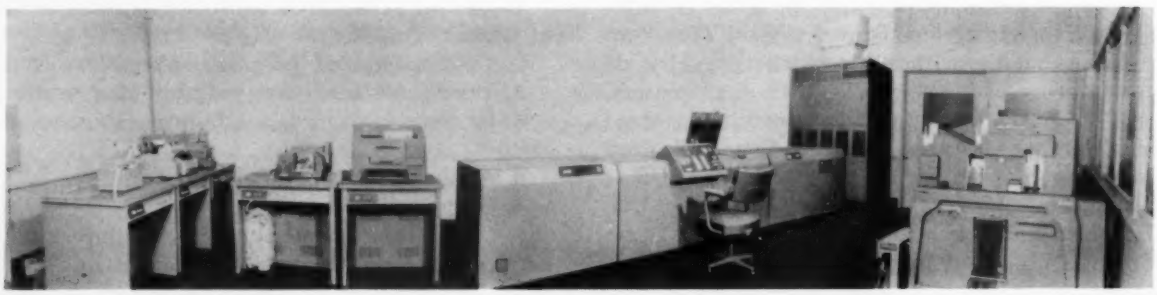
The Electro-Technical Laboratory has completed a transistorized photo-electric reading apparatus capable of reading 73 alphabetic, numeric, and special characters.

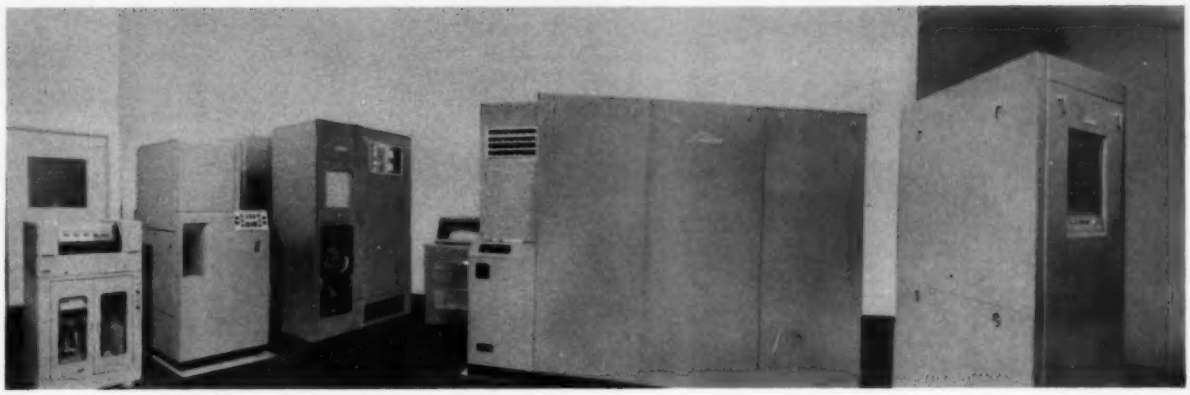
Machine translation

The "Yamato" English-to-Japanese automatic translator, now in use, features a low-speed magnetic drum memory with an 820,000-bit capacity. Typewritten English is accepted directly by the reading apparatus; the translator comes out in typewritten Kana (Japanese alphabet) and English capital letters.

While many computers of foreign manufacture have been installed in Japan, her own electronics industry is rapidly developing equipment, systems, and the home market. The industry-sponsored JEIDA organization is actively supporting all

FACOM - 212 (JEIDAC - 201)





TOSBAC - 2123 (JEIDAC - 202)

three efforts. From Japan have already come significant contributions to the state of the art in computers. The need for electronic computer equipment and systems in Japan is being filled through a combination of competition and voluntary cooperation among domestic electronics manufacturers.

NEAC - 2203 (JEIDAC - 101)

COMPONENTS:
Control console
Main computer
Punch tape typewriter
Core memory
External magnetic drum
Magnetic tape control
Magnetic tape handlers (3)
Line printer control
High speed line printer
Card input-output control
Card read and punch unit

HITAC - 301 (JEIDAC - 102)

COMPONENTS:
Control console
Main computer
Tape punch typewriter
Magnetic core memory
Line printer
Card input-output control
Card read and punch unit
DC power supply

FACOM - 212 (JEIDAC - 201)

COMPONENTS:
Main computer
Card control apparatus
Card sensing and punching unit (IBM 513)
Accounting machine (IBM 405)
Tape control apparatus
High speed punch
Photo tape reader
Tape punch typewriter

TOSBAC - 2123 (JEIDAC - 202)

COMPONENTS:
Main computer
Card sensing and punching unit (Remington Rand)
Code converter (Remington Rand)
Input-output control apparatus
High speed line printer
External magnetic drum
Program test panel ■

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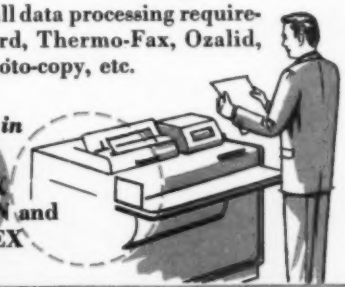

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The rest is automatic. The equipment reads the card, transmits the information over your regular telephone lines, and reproduces an identical punched card, ready for processing. You can connect a number of departments, plants, offices or customers with this 1001 Data Transmission System.

This is another example of IBM TELE-PROCESSING* Systems which help business act faster by speeding up collection of the facts on which action is based. TELE-PROCESSING Systems are available for coordination of anything from a warehouse to an entire company.

*Trademark

At the data processing center, an IBM Card Punch receives data by phone and automatically punches it into a card, ready for processing.

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DATA PROCESSING

By Roger T. Biringer

Port-A-Punching for Data Processing

On the spot card punching

PORT-A-PUNCHING, an infant in the data processing field, made its debut approximately three years ago. Since that time, however, this form of documenting information has been gaining momentum throughout the country.

Port-a-punching is a fast, accurate means of manually punching holes in cards, making it possible to create punched card documents anywhere at anytime. By this means, we can eliminate the necessity for base data to be routed by some form of transmittal to the data processing center for conversion to punched cards. Transmittals of source data always run the risk of misinterpretations by the key punching personnel. Punching the data at the source by those most informed will tend to hasten the reports and provide more accurate data.

To Port-a-punch, an individual needs a small portable plastic unit 8½ x 4½ x ½ inches thick, a pencil-like device and pre-scored cards. The unit has been designed to be carried in the pocket. The operating mechanics are simple: A pre-scored card is inserted into the punch assembly directly under a template, automatically aligning itself with the template holes. The pencil-like tool is pressed into the template holes forcing out a pre-scored position of a select column of the card. The card, after all the pertinent information has been punched, is removed from the device and sent directly to the data processing center for tabulation and analysis.

Application

Through this method of documentation, salesmen's calls can be used most advantageously for market analysis and sales analysis. With many firms, this system could replace the hand-written call reports that salesmen prepare. While calling on the customer and during his conversation with the purchasing agent, the salesman punches answers to his questions directly to the pre-scored card. The required information has been printed on the card facilitating quick operation of the punch. Questions are asked in such a way that a validity check can be made of the answers. This would be the result of using two or more questions stated differently. The answers should be similar, if not identical.

The system expedites the information to the home office for quick analysis. The information will be accurate since it is on the spot card punching. The information will be accurately analyzed since hand-writing analysis will be eliminated. Market information not previously available anywhere will now be readily obtainable. We will get accurate information on competitors' products as well as on our own. Through this procedure, we can ascertain a great deal of valuable information and prepare this data into valuable working tools for management.

1. Who are the customers requiring concentration and attention?
2. How and where do we direct our promotional mailings?
3. What types of mailings and education are needed?
4. Where is our competition hurting us the most?
5. What is our competition doing in regard to advertising, sales gimmicks, deals, etc.?
6. What are the customer needs?
7. We can measure our potential nationally.
8. We can rate our salesmen against his potential.
9. We can determine whether the salesmen are delivering our message properly. Are they making a sufficient number of calls or are they calling too frequently?
10. Are we providing our representatives with the proper guidance and tools to sell?

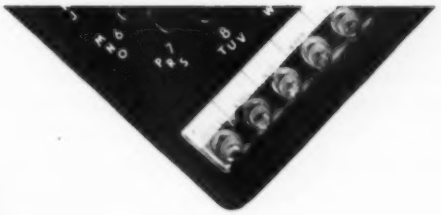
Summary

Although the call system lends itself nicely to port-a-punching, it is not the only use for the system. Many other applications lend themselves to port-a-punching, and some fit into the mechanics of the system more comfortably than the aforementioned market analysis.

Through this system of market analysis, however, information obtained will benefit the customer, through better service and better products; the salesmen, through better selling hints and techniques; and the company with a better knowledge of the market, which should result in a greater percentage of the available market and development of new products. ■

PWI

"001" KEY PUNCH



A key punch at your fingertips . . . personalized . . . convenient . . . time saving. PWI offers you the "001", a high precision punch of well proved design—entirely mechanical in operation—priced within a range where purchase on a personalized-use basis can be well justified.

This is a compact punch . . . needs only a small space on your desk top or on computor console. It weighs only a few pounds . . . is easily carried wherever needed. The one-piece solid aluminum base is light in weight yet provides substantial thickness and the solid "feel" every good mechanical key punch must have.

The PWI "001" is being widely used as an extremely handy auxiliary punch . . . for example to replace damaged cards immediately without need to interrupt normal key punch routine. The numerical keyboard is standard design with fourteen keys which include those for space and release. For your convenience, character codes are engraved on the cover plate. Tab stop with quick release and calibrated gear rack make it easy to set card to desired column. Alphabetic or multiple punching is possible without back spacing. Operation is simple—positive—straightforward!

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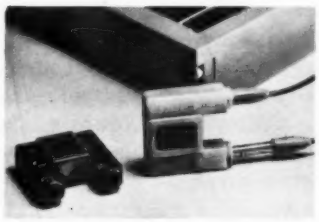

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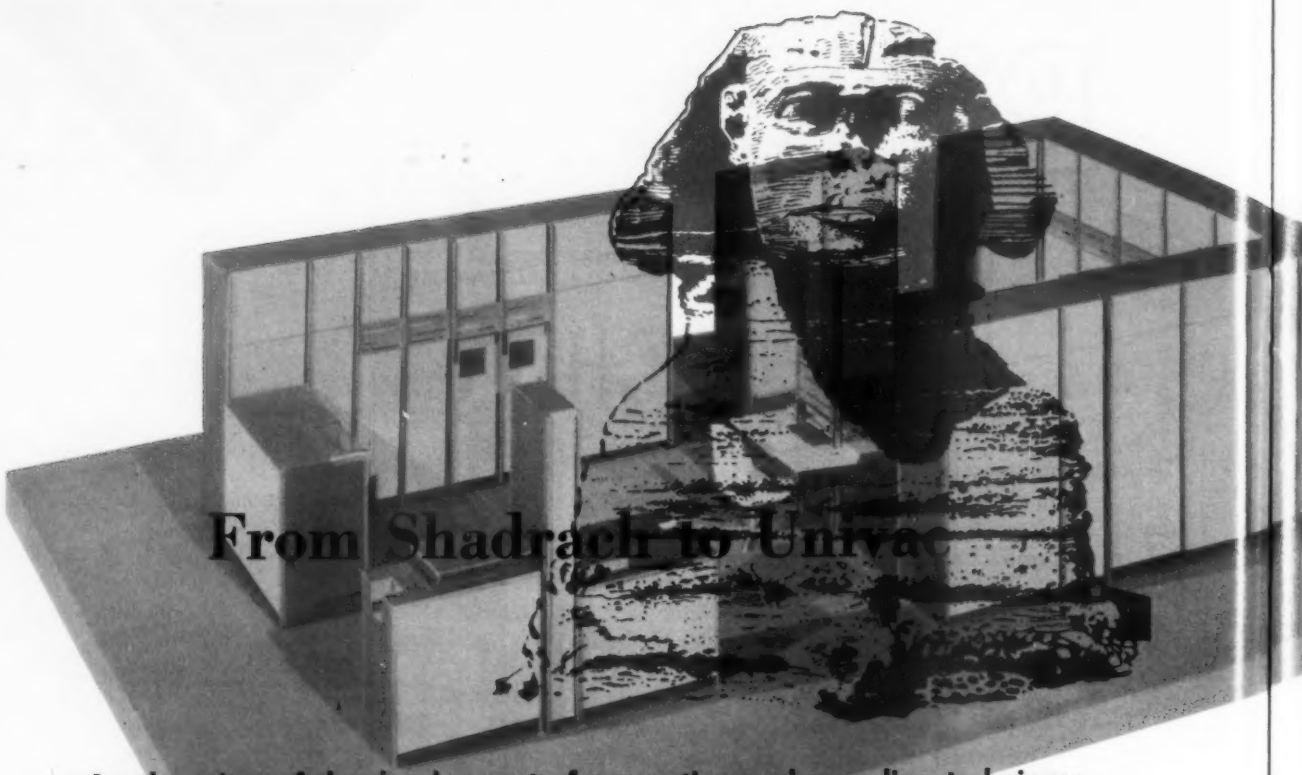

From Shadrach to Univac

Another view of the development of accounting and recording techniques

MAN'S ATTEMPT to record business transactions is, no doubt, as old as man himself. In order to keep a record of his trade and barter, the early businessman used perhaps pebbles or carved notches on a nearby tree. In any case, it is known that business transactions date back further than the earliest records extant. The history of the records actually available covers the period from Meshech, Shadrach, and Abednego of Babylonian times to Bizmac, Modac, and Univac, Model O, of the present day.

As far back as 4,500 B. C. Babylon was a well developed civilization and commercial center. The earliest records of any actual business transactions, however, are dated some 1900 years later, or about 2,600 B. C.,The businessman of "modern" Babylon had a scribe record his sales and contracts on a clay tablet. The clay was in the form of a slab and was just moist enough to retain the impression made with the stylus, a rod with a blunt, triangular end. After recording the transaction, the scribe placed the tablet in the sun or baked it in an oven to make the record permanent.

Another important development of business records in Egypt was the use of papyrus and the calmus. Papyrus was a type of "paper" which was made by gluing together the thin sheets of the bark of a reed plant to form a fairly substantial writing surface. The calmus was a sharp-pointed pen also made from reed. The exact date of the invention of these writing materials is not known, but their use in Egypt may even antedate the clay tablets of the Babylonians. It appears, however, that papyrus was used in the Greek and Roman civilizations from the sixth century B. C. until the fourth century of the Christian era.[1] Although papyri sheets were usually only about two feet long, a number of sheets were often pasted together to form a roll reaching lengths of as many as fifty feet.[2] It is rather interesting to note that modern-day electronic accounting has reverted to the use of the roll of magnetic or paper tape. Papyrus was important until it was replaced by parchment which also was joined together to form rolls.

Another writing device of ancient times was the tablet with leaves or sheets of wood which were covered with wax. A stylus was used to scratch a record on the surface. Such records, of course, were not permanent, since the wax was soft and the writing could be obliterated. However, in Cicero's time (*the latter part of the last century B. C.*), most of the Roman accounts were kept on

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[1]Littleton & Yamey, *Studies in the History of Accounting*, p. 47.

[2]Wilmer L. Green, *History and Survey of Accountancy*, p. 35.

these waxed tablets. Added progress was made when the Romans began to use a *codex*, or book, with leaves of parchment which replaced the waxed wooden sheets.[3]

Paper apparently did not replace parchment and other materials for business records until many centuries later. Although paper was invented in China as early as the year 105 A. D., it evidently was not brought to Europe until 1150 when it was introduced by the Moors into Spain. The use of paper was slow to spread to other countries in Europe since it was centuries later before paper mills were established throughout the continent: in Italy, about 1276; in France, about 1348; in Germany, 1390; and in England, 1495.[4]

Tallies for Taxes

One particularly interesting development in the story of business records is the use of tallies in England. Although the scoring or notching of sticks may go back as far as prehistoric times, tallies were most widely used, perhaps, in England after the invasion of William the Conqueror in 1066.[5] William took title to all property in the name of the crown and had a survey made showing all the properties included and the tributes, or taxes, due on the property. The details of the survey were included in a record called the Doomsday (*or Domesday*) Book, and this book was the record from which the assessments and revenues of the crown were established.[6]

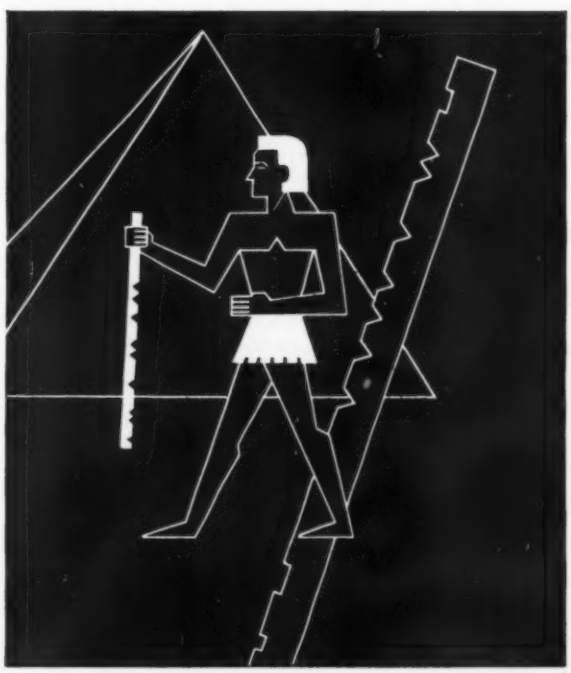
The sheriff of each county was held accountable for the royal revenues assessed in his jurisdiction, and he was required to settle twice a year with the Exchequer. At Easter the sheriff appeared to make an advance payment and in turn he received a receipt in the form of a tally. The tally was a narrow shaft of wood on which notches were cut to represent pounds, shillings, and pence.[7] An inscription on the tally indicated the nature of the payment. The tally was then split in two, one part being retained by the sheriff as his receipt and the other being kept by the department of the Exchequer. At Michaelmas the sheriff appeared before the Exchequer for the final accounting of the crown revenues. Settlement was made on a table which was covered with a checkered cloth. On one side in appropriate squares were placed dummy counters to indicate the amounts due the crown; on the other side were placed the vouchers for authorized expenditures, cash or other items accepted as legal tender, and the sheriff's half of the tallies. If the latter matched the halves held by the Exchequer, they were accepted as bona fide receipts. If, on the other hand, the sheriff's portion of any tally had been altered, the sheriff would be liable to imprisonment.[8]

It may appear strange to us that a device as crude as a tally might be used as an accounting record. However, the sheriffs in this early period of English history, and even many of the nobles, were relatively unlettered. Even after better writing tools were readily available and the people were more literate, the use of the tally continued. In fact, a special department of the British civil service was set up to handle tallies so that cutting of these records became a vested interest. As in later days, there were men who opposed change and kept the tally system in operation for another hundred years after they served any useful purpose. It was not until the early 1800's that Parliament finally passed a law eliminating the requirement for the tally. Finally, in 1834 the order was given to throw them into the heating stoves of the House of Commons. "So excessive was the zeal of the stokers that the historic Parliament buildings were set on fire and razed to the ground. The tallies perished in a blaze of defiant glory, leaving, as far as was then known, not a wrack behind."[9]

Tallies, of course, were used mainly for the settlement of government revenues in England.

(continued on next page)

[3]Littleton & Yamey, *op. cit.*, pp. 68-71.
[4]"Paper", Columbia Encyclopedia (2nd ed.).
[5]Littleton & Yamey, *op. cit.*, p. 75.
[6]Wilmer L. Green, *op. cit.*, p. 44.
[7]Richard Brown, *A History of Accounting and Accountants*, p. 42.
[8]*Ibid.*, p. 43.
[9]Littleton & Yamey, *op. cit.*, p. 85.



During their early use, the development of trade in Italy resulting from the Crusades gave commercial accounting a strong impetus. Double-entry bookkeeping actually developed from the need to record the transactions arising from this increased trade. The double-entry system, however, was not spontaneously invented but took form gradually, in fact, almost unnoticeably, until it culminated finally in a full-fledged system sometime in the fourteenth and fifteenth centuries. The earliest set of double-entry books still extant is one from Genoa dating back to 1340. Showing further development are the records of Soranzo Brothers from the year 1406 through the year 1482 in which they closed the ledgers and computed profit annually.[10]

Early Italian accounting

The system developed by the Italian city-states (*including Venice, Genoa, and Florence*) came to be known as the "Method of Venice," and was first described in book form by Luca Paciolo (or Pacioli) in his *Summa Arithmetica, Geometria, Proportioni et Proportionalita,* published in Venice in 1494. Paciolo gives a detailed description of the double-entry system then practiced, and the method he outlined forms the basis of double-entry as we know it today. However, Paciolo also understood the crux of the problem of record-keeping since he pointed out that the purpose of accounting was "to give the trader *without delay* information as to his assets and liabilities."[11]

From this point forward to the next 400 years or so, there was a further refinement and development of accounting theory; however, relatively little progress was made in speeding up the process of recording business transactions and providing mechanical aids to calculation.

The abacus, of course, had been in use for 2,000 years and even today is more widely used than any other type of calculator.[12] The present advanced accounting equipment, however, grew from an invention which hardly seems related to accounting records: the automatic loom developed in France by Joseph Marie Jacquard some 150 years ago. The outstanding feature of this invention — and its relation to accounting devices — was its ability to follow a set of instructions stored on paper tape which directed the weaving process. This same principle eventually would be adopted by the developers of punched card and electronic accounting systems, as well as by the pioneers of the automatic factory.

The first attempt to use the principle of stored instructions in an accounting or mathematical application was made by Charles Babbage, who, in the 1830's, tried to construct what he called a "difference engine." His machine got little beyond the planning stage, but his objectives indicated that he was considerably in advance of his time. The "difference engine" was to have contained a memory unit made up of a bank of counters, a mill or arithmetic unit where the mathematical computations would be made, and also a control unit for directing the operations. A type of punched card was to feed information into the machine. So high were his goals, that the capacity of his memory unit would have exceeded that of some of today's advanced equipment. Business, however, was not sufficiently developed to require such a machine, and technology was not far enough along to provide it, so that Babbage's "difference engine" was never built.[13]

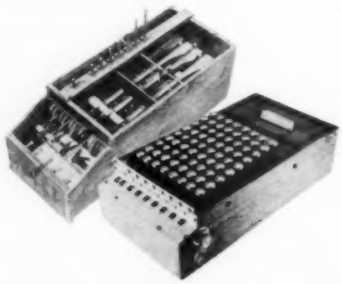
Cash register and adding machines

The development of the typewriter and the use of the letter press may be considered as steps forward in the area of data processing since these two devices have proved their usefulness particularly in the recording and reporting functions of handling accounting data. More directly related to the accounting function, however, was the cash register, introduced in 1882. This was followed in 1885 by Felt's "Macaroni Box," which was eventually developed into the Comptometer, still widely used in today's business office. About 1889 William Burroughs incorporated in his adding machine, which was called the "Listing Accountant," the adding machine tape thus giving the machine the ability to record and summarize as well as calculate. This innovation also helped to eliminate some of the human errors of transcription.

The Burroughs was a ninety-key machine with a capacity of up to nine decimal digits. In 1914 Oscar and David Sundstrand improved on the

[10]Wilmer L. Green, *op. cit.*, p. 58.
[11]*Ibid.*, p. 91.
[12]Haskins & Sells, *Data Processing by Electronics*, pp. 9-10.
[13]William Eustis, *A Primer to the Automatic Office*, p. 41.

FELT'S "MACARONI BOX" — 1885



THE FIRST COMPTOMETER — 1887

large keyboard by their invention of the ten-key adding machine and thus increased the speed of operation. Later, electric motors were incorporated into the adding machine to provide still greater speed and facility, but the adding machine has remained a "man-operated" machine and cannot be considered as automatic.

Somewhat paralleling the development of the adding machine was the invention of the Monroe calculator by Frank Baldwin and Jay R. Monroe. This was a non-printing device, but it went beyond the adding machine in that it could automatically multiply and divide at a much greater speed.

Accounting machines

The development of what might be called an accounting machine did not come until after the close of World War I. This was the machine with the tabulating carriage, which had the ability to sort information into a number of columns in addition to the functions of recording, calculating, and summarizing which were already possible on the adding machine. There have been many variations of this type of equipment including the billing machine which can automatically extend balances, providing copies of the original document; and payroll machines which can handle withholding taxes and other deductions in arriving at the net paycheck. All these devices — adding machines, calculators, and accounting machines — while quite efficient, are still considered as "manual" type equipment since they require an operator to perform each unit of operations.

Punched card equipment

The last step between manually operated accounting machines and electronic data processing equipment is the punched card system. This new concept developed gradually over the period from 1900 to 1915, then with increasing speed in the 1920's. One of the most important figures in this development was Dr. Herman Hollerith, an employee of the Bureau of the Census. He adopted the principle used by Jacquard in the automatic loom — giving information and instructions to a machine in the form of holes punched into paper or a card. He thus successfully completed the first statistical machine actuated by punched cards (*1897*).[14] With the urgency to assemble large quantities of census data in a short time and with the commercial use of such equipment being more evident, the need for punched card equipment was fairly obvious. Likewise, technology was far enough advanced to construct the equipment. Therefore, unlike Babbage's dream, the punched card idea became a reality. From 1900 to 1915 over three hundred companies adopted punched card equipment.

In the punched card system information is written out in the form of holes in cards, the holes being punched in the form of a code which can be read by the machine. The card can be made to carry either alphabetic or numeric data. The bottom ten rows of the card are marked to designate numerical information. Two top rows are used in combination with the lower rows to indicate alphabetic data. In the case of the IBM card, for example, a single hole in the 9's column actually means a "nine" to the machine. However, a hole in the 9's column, plus a hole in the "shift" column, or upper register, means the ninth letter of the alphabet, or the letter "I". Again, a hole in the 9's column, plus a hole in the other "shift" column, means the eighteenth letter of the alphabet, or "R". A machine which can read such coded information so readily may appear relatively intelligent. Actually, the only decision the device can make is to answer the question: "Is there a hole there?" The fingers or brushes of the machine detect this information by electronic contact and determine what is to be done with the information and the card.

The contact at the point of the hole on the card plus the system of instructions placed in the machine in the form of a plug-board indicates whether the machine should make a computation, sort the card, or print. In other words, through the use of the card, the machine can perform four basic steps automatically: recording and sorting information, making calculations, and summarizing the data. The principal duties of the operator (*or operators*) are to feed the cards into the machines, to move them from one machine to another, as called for by the procedure in process, and to provide the machines with the necessary processing instructions. The machines do the rest, with the result that the punched card concept has provided the fastest and most efficient system for data processing up to the present time of the newer electronic data processing equipment. The punched card system may, incidentally, be classified as an electro-mechanical device as opposed to the more recent electronic equipment.

One of the initial steps in the punched card system is the transfer of data in the form of sales orders, purchase invoices, inventory requisitions, etc., into a form that the machine can understand. This conversion is done in the keypunch operation. The key punch, similar to a typewriter, punches cards which are fed into the machine automatically and are temporarily stored for further processing. If the information initially punched into the card is not correct, then, although all other operations may be carefully controlled, subsequent results will be incorrect. Therefore, the key punching

[14] *Ibid.*

operation is usually verified by a second clerk.

When the cards have been punched and verified then the only steps required by the operator are to move the "decks" of cards from one piece of equipment to another for processing, and to insert the correct set of instructions (*in the form of the plug-board*) into the machines.

Special pieces of equipment are generally used for the following principal operations: *Sorting.* This operation involves sorting the cards into separate groups, such as classifying sales by area or by salesmen. *Collating.* This step includes combining two separate decks, or stacks, of cards and arranging them properly in one deck in some predetermined sequence, such as sales invoice number, expense account number, etc. It would also include inserting into a deck at desired intervals blank cards for later use in recording results of some computation. *Computing.* The computing unit of the machine will receive certain data from the cards being processed and manipulate those data in accordance with instructions. The results will be punched into one of the cards being processed or into a new card depending on requirements. *Tabulating.* The tabulator is the device which prints out the results of the previous steps either in detail or in summary form. As a writing machine, it was unequaled until the new high-speed printers were developed to keep pace with the faster electronic equipment. Tabulators usually write a complete line at a time, including up to 120 alphabetical and numerical characters.

Data may be recorded in pencil on special types of cards which will be automatically punched by a special machine in accordance with the pencil markings. This operation is known as "mark-sensing." It permits a card record to be made at some point where it may not be convenient to key-punch the card with the usual equipment. For example, "marked-sensed" cards have been used in reading public utility meters for billing purposes.

Where regularly recurring data are used in a card system, certain types of cards may be automatically pre-punched rather than key punched in a separate individual operation. For example, if a company sells a standard product in quantities of a dozen or gross, cards may be prepared automatically in advance for frequently recurring quantities of regularly sold products. Customer cards, including names, addresses, and other pertinent data, may also be pre-punched. As sales orders are received, then the pre-punched cards are "pulled," or removed, from a "tub," or storage file, and put into process.

Thus, it may be seen that the development of the punched card has been a tremendous step forward in solving the problem of handling larger and larger quantities of business information essential for retaining control of corporations which have grown beyond the size where hand, or even mechanical accounting devices would have been adequate.

Electronic computers

As mentioned earlier, the standard punched card machine may be classed as electro-mechanical. Although it represents a vast improvement over earlier equipment, it falls short of present-day maximum requirements. First of all, the physical or mechanical manipulation of the cards inside the machine limits its speed. Secondly, since each machine is relatively specialized and designed to perform one basic operation, moving decks of cards from one machine to another with necessary sorting and merging not only takes time but also leaves the way open to human error.

The first successful attempt to try to coordinate these various operations in a single computer was made by Professor Howard Aiken of Harvard working in conjunction with International Business Machines from 1937 to 1944. The first so-called "computer" was made up of seventy-eight adding machines and desk calculators combined into one machine and controlled with a piano player type roll of perforated paper. Thus, the ideas used by Jacquard in his loom and by Babbage in his "difference engine" were finally combined in the Mark I, as this first general computer was called.

Two years later, in 1946, a second electronic computer was completed at the University of Pennsylvania. Designed by J. Presper Eckert and John W. Mauchly, it was called the Electronic Numerical Integrator and Calculator or ENIAC for short. Its main purpose was solving special problems in ballistics at the Aberdeen Proving Ground, but it provided certain electronic improvements which permitted more rapid computations and which have been adopted by computers designed for business applications. In brief, it made electronics available as the means for reaching today's high computer speeds.[15] The designers of ENIAC also developed UNIVAC at the request of the Bureau of the Census which required equipment capable of digesting masses of information at optimum speeds. The first UNIVAC was built and completed by April 1951 for the population poll of a decade ago, but it was not until three years later that UNIVAC was given its first commercial assignment at General Electric's Appliance Park in Louisville, Kentucky. This was, indeed, the birth of the computer age for business, and its repercussions on accounting will be felt in our current era as long as there is business to be transacted. ■

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[15] *Ibid.*, p. 50.

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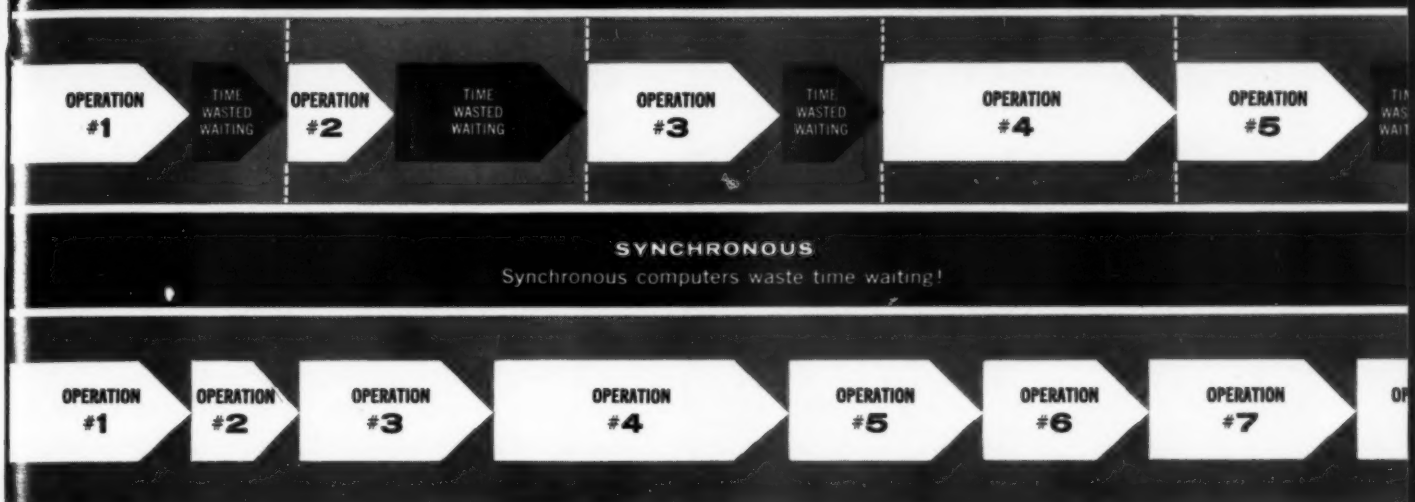

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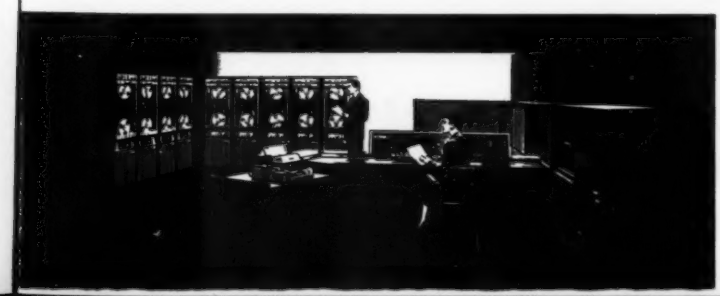

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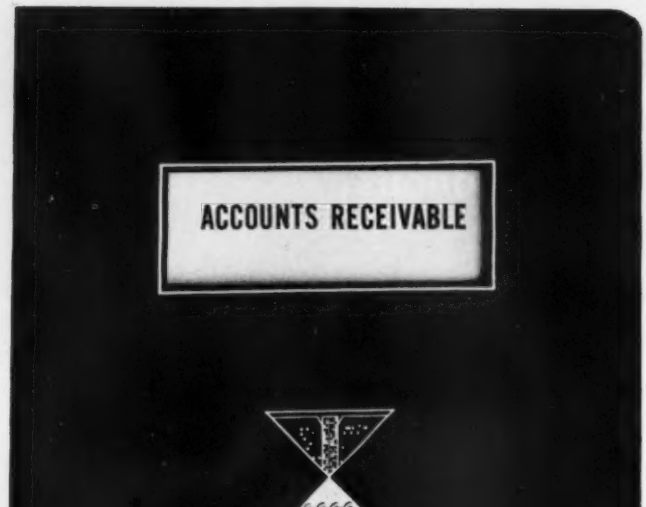

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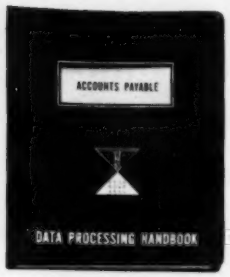

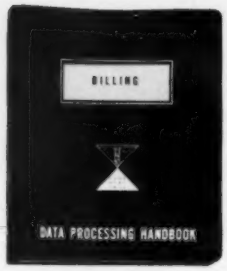

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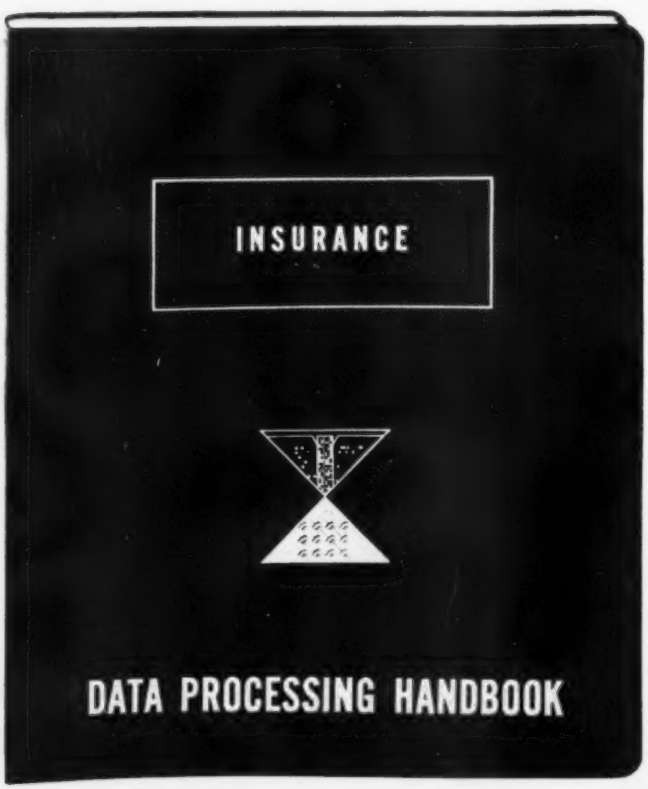

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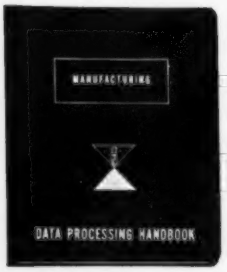

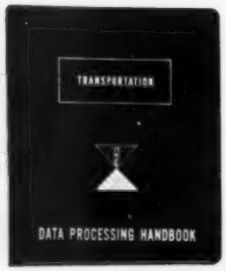

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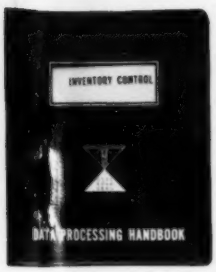

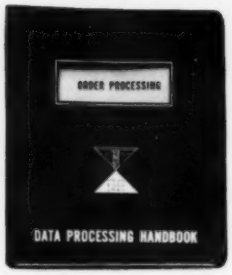

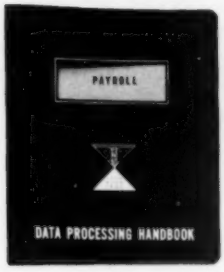

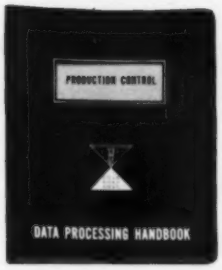

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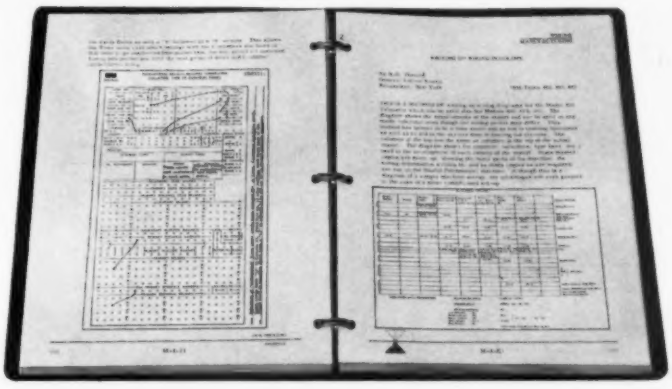

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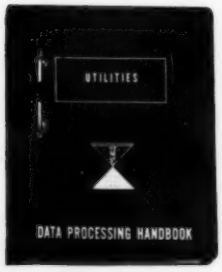

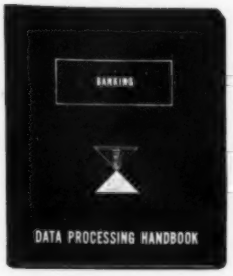

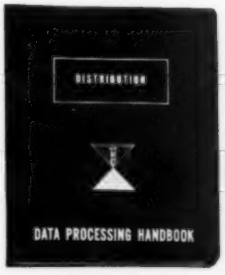

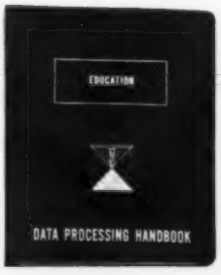

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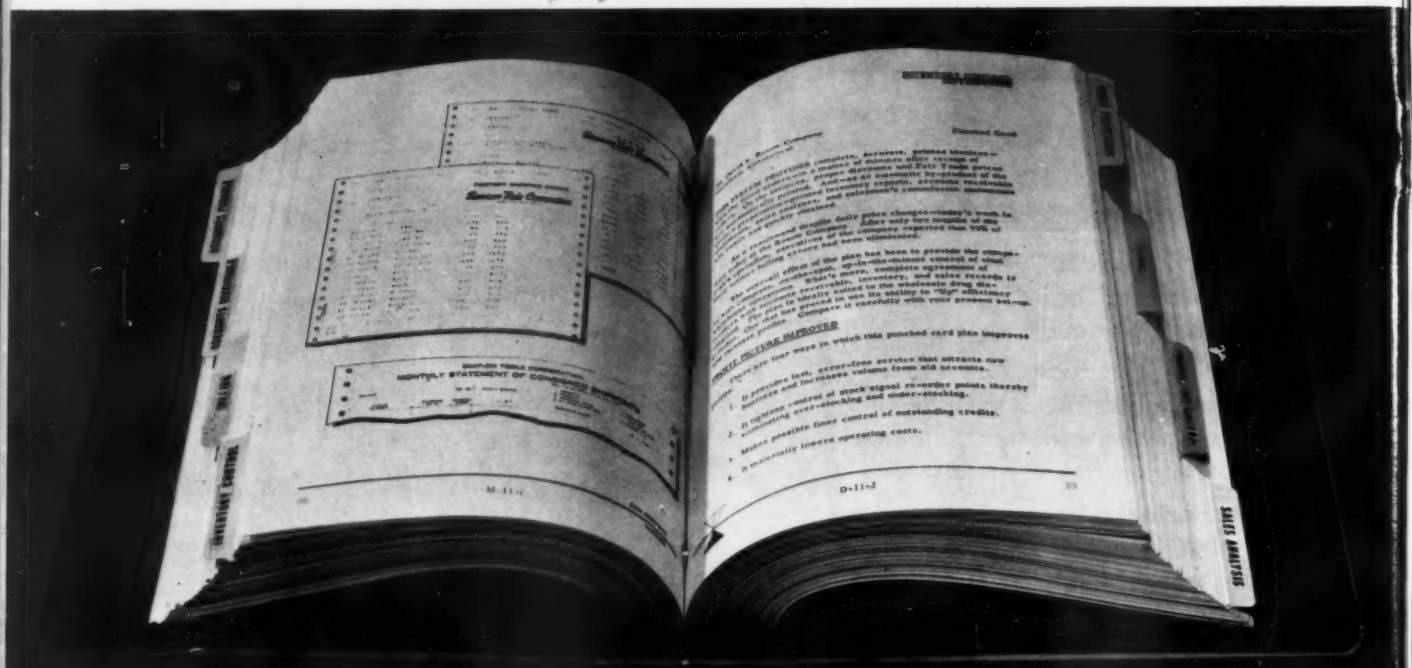

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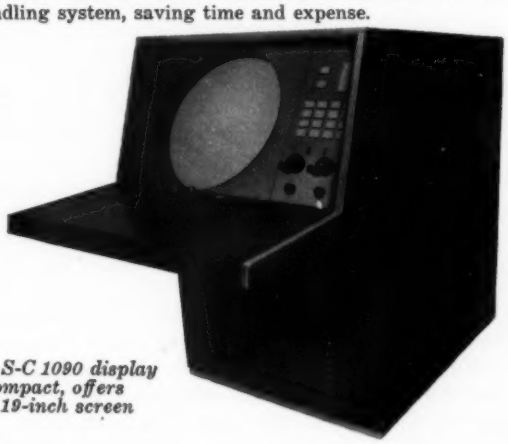
General Dynamics/Electronics' new S-C 1090 is the first "off-the-shelf" computer display featuring high character legibility on a large CRT screen. The S-C 1090 incorporates an improved 19-inch CHARACTRON® Shaped-Beam Tube and is capable of displaying 1000 flicker-free, high-resolution characters simultaneously anywhere on the tube face. Thirty thousand or more characters per second may be displayed with extreme brightness and contrast.

MOST VERSATILE DISPLAY. The S-C 1090, operating either on-line or off-line, is designed to monitor digital computer systems and present data for decision or information purposes. Alphanumeric or symbolic characters, and vectors may be presented singly or in combination.

Maximum flexibility for various applications has been provided by a number of special modular optional features for the S-C 1090 display which include:

1. *Internal Test Pattern Generator*—permits complete set up and calibration without tying up the computer or data handling system, saving time and expense.



The S-C 1090 display is compact, offers full 19-inch screen

2. *Vector Generator*—capable of drawing straight lines between points on the tube for graphic presentations.

3. *Format Generator*—reduces the S-C 1090's input requirements and doubles display rate from computer.

4. *Input Register*—provides console with buffer storage for position and character selection information.

5. *Offset & Expansion*—can enlarge any segment of tube screen to full screen size for more detailed view.

6. *Category and Feature Select*—allows selection of information for display without computer intervention.

SUPERIOR CHARACTER FORMATION. The CHARACTRON tube's unique method of shaped-beam character formation offers proven advantages over less precise line-segment, dot, or scan character forming techniques.

Symbols and characters are obtained by extruding electron beams through stencilled openings in a metal disc called the matrix. After passing through the matrix, the character-shaped beam is directed to an appropriate spot on the tube face. Most matrix have 64 characters.

COMPACT DESIGN. The S-C 1090 is a compact unit measuring 32 inches in width, 45 inches in height, by 66 inches in length. The unit's low silhouette allows operators to actually look over the top of the console for simultaneous viewing of the tube screen and projected large screen displays.

S-C 1090 APPLICATIONS. The S-C 1090 is capable of tabular, situation or graphical presentations and can be used in a wide range of computer intervention, monitoring and retrieval jobs. It is suitable for laboratory, simulation, Air Traffic Control and surveillance applications.

For additional information on the S-C 1090 Direct View Display or other General Dynamics/Electronics readout and display systems, write General Dynamics/Electronics, Information Technology Division, Dept. B-52, P. O. Box 2449, San Diego 12, Calif.

GD

GENERAL DYNAMICS | ELECTRONICS

Circle no. 9 on reader service card.

DeParis on EQUIPMENT —A Monthly Feature

IBM 1301 Disk Storage Unit

JOSEPH R. DE PARIS

DATA PROCESSING advanced one more long stride forward with the advent of IBM's 1301 Disk Storage Unit. The concept of "total systems"—the complete, fully integrated, information system—took on added life and vitality and the imagination of the systems man was stirred by a new challenge to his ingenuity and vision. For here is, not just a larger capacity, faster, random access unit, but a new dimension in the conception and efficiency of data processing systems.

The 1301 disk storage unit is a new random access, disk storage file whose capacity ranges from 25 million characters to 250 million characters with a 1410 system; with 7000-series systems up to 280 million characters are accommodated. The 1301 is offered for use with the 1410, 7070, 7074, 7080 and 7090 data processing systems. (Note the omission of 1401 which continues to use the Ramac 1405 as its random access unit.)

Each module of the 1301, ten of which can be incorporated in one 1410 system, has 20 data disks providing 40 recording surfaces. Each surface has 250 tracks and each track can hold up to 2,500 characters for a total of 25 million characters. Each module has five additional disks used for timing and control: four are engineering disks and one is a format disk which defines record size.

Access mechanism

The access mechanism resembles a comb, positioned vertically between the disks with read/write heads as the teeth of the comb, placed above and below each recording surface. This is one of the more interesting aspects of the 1301. Since each surface is provided with its own read/write head, all vertical movements in accessing a record have been eliminated. To access a record, the entire comb moves laterally across the disk surfaces until the specified track is located. Thus, when the comb is positioned to read a track on one surface, it is also positioned to read the same relative track on each of the other 19 disk surfaces. Accordingly, in terms of comb movement, these tracks may be considered common. Since there are 2,500 characters in a track, one positioning of the comb brings 100,000 characters (2,500 x 40) under the read/write heads. These may be accessed without comb movement.

This new access mechanism brings about a new concept in file organization. Unlike the 305 and 1405, wherein related data are stored on adjacent or nearby tracks of the same disk to minimize movement of access arms, data in the 1301 are stored in the same track position of each disk surface, providing a vertical relationship for similar data.

Another feature of this comb-like read/write mechanism is in raw speed as this comparison between 1405 and 1301 indicates:

	1405	1301
Seek	565	120
Latency	25	17
Read	10	3
Wait	40	31
Write	10	3
Wait	40	31*
Write Check	10	3*
	700 ms.	208 ms.

*Since the Write Check is optional on the 1301, an additional 34 milliseconds may be taken off the 1301 time. Incidentally, dual access (two comb mechanisms) is planned and will be announced later on.

Format disk

Rotating directly above the 20 data disks is a format disk, through which variability and flexibility of record formats are achieved. This disk defines the records on each of the 250 tracks. The record lengths on the 40 recording surfaces conform, track by track, to those specified on the corresponding track of the format disk. A separate head reads the format disk, as the data disks are reading or writing, defining start and stop points. Variable length records are possible between tracks and within tracks by proper definition on the format disk.

In application to everyday problems, the advanced features of the 1301 stimulate new approaches to the design of data processing systems. In many systems, the sequential nature of tape storage and the random nature of disk storage are perfect complements for one another. Analysis may reveal that certain records on tape and others on disks combine to provide the most effective system. For example, data from tape may be placed in the random access file in which records are stored in report sequence. Tape sorting for such applications would be entirely eliminated. Where sorting is required, the 1301 has sorting abilities which surpass tape sorting. Accordingly, in determining the number of tape drives needed, consideration should first be given to the power a disk unit brings to the system. Often it may be found that two tape drives will suffice when a disk file is attached. It is apparent that the 1301 offers efficient sorting of data in addition to the advantages of random processing.

Adding a 1301 to a computer system may bring about more efficient and effective processing. By using the 1301 as a working storage medium, the number of tape reels, tape runs, and tape handlings may be significantly reduced. By substituting the disk unit for work tapes holding information on a temporary basis, mounting and dismounting many reels of tape is eliminated with an attendant reduction of wasteful set-up time. Utility programs, sort routines, and regular programs may be stored on disks

(continued on page 56)

By William E. L. Young

Determining Equipment Needs

The use of a projected, typical eight-hour day.

"WILL YOU GET THE RIGHT COMPUTER FOR YOUR NEEDS?" This little question usually emphasizes "right computer" and by doing so seems to suggest that after a prospective customer has a pretty good idea of the major tasks to be performed that manufacturers of equipment are asked to suggest ways of performing these major tasks.

This article discusses three things: a) identifies the generally accepted method of submitting requests for proposals, b) discusses the type of information that is lacking, and c) recommends a different procedure to obtain information from manufacturers.

It has been years since prospective computer customers have ordered equipment without defining some major tasks. Nowadays, it is even possible to give computer manufacturers the process charts or programs which are being used. Perhaps prospective customers use these three or four major programs some 30 to 50 hours per month and consider this to be a significant portion of the total workload. But, when manufacturers submit their proposals of how they would perform the work, prospective customers often do not obtain enough information to form the basis of a good comparison.

What is it that is most often lacking in the generally accepted procedure? Will the equipment, selected on the basis of three or four major present-day programs, be the right equipment in two or three years, just when the payoff of the investment in conversion and programming begins to occur? Many times drastic changes have evolved in fundamental record structure, in programs, and undoubtedly in reports or in exception analysis. The programs being done now and which are often considered as basic may significantly change, and rightly so, under the dynamic leadership of your data processing analysts and programmers.

The present method is conducive to asking this kind of question: "Precisely how would this task be done now?" or "Precisely what is the best way to do this job?" These questions are much too confining, obvious, and restrictive. Essentially these questions lend themselves to one type of growth only and that is *volume* — doing more of the same task or tasks.

However, growth in volume is not the only kind of difference which should be anticipated. The demand for the use of every element of the computer and peripheral hardware may increase or decrease in a limited span of time and the prospective customer is certainly in the best position to project the changed condition.

Projected usage

Is it not better, more valid, and more accurate to determine equipment needs by projecting the usage of each element of the hardware configuration at a point of time, say two years from delivery of the new equipment?

This is what the State of Ohio, Department of Finance, Data Processing Center did. The assignment was to project the activity of the Data Processing Center for a typical eight-hour day three years from January, 1961, allowing one year for the delivery of equipment.

The Data Processing Center does payroll and personnel record keeping; inventory work; lists of indexes of births, deaths, and marriages; appropriation accounting and budgeting; licensing; and many other tasks of the business or commercial data processing type. The Center does highway engineering and advanced statistical analyses of many types.

Personnel in the Center established what was happening to the printing workload, the amount of logical decision processing, the size of various records, the volumes, the exceptions, and from these a composite day was established. Four business type problems and one engineering type problem were devised which would have the composite of the projected input, processing, and output.

In addition to these generalized problems—which are specific enough that a manufacturer could be asked to program and run each problem — the manufacturers were given basic hardware characteristic forms to complete, were asked to submit on forms their recommended configuration of equipment, and asked to discuss their software.

The benefits from the use of a projected typical eight-hour day in computer evaluation are as follows: 1) The customer should be working from a more exact description of activities; 2) Manufacturers need to spend less time in systems analysis; 3) Manufacturers' equipment capabilities can be readily compared since differences in input, processing, output, and through-put are very obvious; 4) The customer has more facts more understandably presented. ■

By Henry H. Krueger

Reports for Modern Management

Data required in reports—seed, weed, thin, and garner

THE PREPARATION OF REPORTS is nothing new. The Egyptians kept records of grain in storage, the stock ledger of 5000 B. C., and the Pharaoh was kept informed about collections from tribute paying tribes, the accounts receivables of that era. Modern times merely magnified the scope of reports: more people and various levels of management have to know more details, have to be kept up-to-date, and must have accurate data to make decisions.

I want to discuss the various considerations and steps involved in the preparation of a report: In my discussion I shall assume that someone in my organization, a Mr. Smith, has approached me with a request for a report.

I sit at my desk, studying the request: Mr. Smith wants to know how much has been sold of every product he manufactured, in specific geographic territories. My first thought should be: Is a similar report available now in my organization? Suppose that each territory, for its own use, prepares such a report. All I would have to do in this case is to request each territory to send a copy of this report to Mr. Smith.

It might be as simple as that. Should the reports of the various territories go into too much detail, or should they not be uniform in their appearance or content, it might be necessary to extract the required information manually and to transcribe it.

Let me assume that my problem is not that easy. Nobody else is gathering the information in the manner Mr. Smith wants it, and I cannot talk Mr. Smith into modifying his request. I certainly should attempt to talk Mr. Smith into using an existing report; minor modifications in requests for report information will often eliminate the preparation of a brand new report. I would like to see report standardization in any company, not just in the interest of economy but for the sake of uniformity. Mr. Smith wants to — no, MUST be able to — compare his figures with those of Mr. Jones.

In my hypothetical case it looks as if I had to prepare a brand new report. Mr. Smith tells me what he wants and presumably also from where I can get my data. Two pieces of information, both of which warrant further study.

Mr. Smith tells me what he wants, but I can still make suggestions. Some of those suggestions? Rounding of quantity figures to thousands, deleting pennies; showing percentage comparisons rather than rows of figures; summarizing figures on a summary page, and others.

The big problem is always where to get the original data. Possible source documents might be typed reports, shipping notices, invoices, punched cards, or magnetic tape. Regardless of the nature of my source document, I will have to consider and worry about, first — accuracy, and second — coding structure. Let me discuss each problem, starting with accuracy.

Accuracy and coding

Regardless of how mechanized our operations are, humans created the original entries. People

will sell a non-existing product, to a non-existing customer by using an invalid code. Code clerks will omit information, or even worse, will use valid codes incorrectly. Our data will have to be checked. You will ask how we can check all the many items. I cannot check them all, but I can check relatively easily whether information has been left out, whether codes are valid, whether detail entries add up to a control total, and sometimes I can check compatibility of codes. Whenever I detect an error on our source document, I identify the error on an edit list for further study. Whether I assume the data to be correct for the time being depends on the nature of the error and the type of the report.

The other problem I have to discuss is coding structure as related to report preparation. Mr. Smith has asked me to compare current sales with prior year sales for territory one. Has territory one changed since last year? Can I expect changes in the near future? It is not enough to look at the existing coding structure. I have to ascertain that codes have not changed during the period in consideration and, just as important, I should allow for changes in the future.

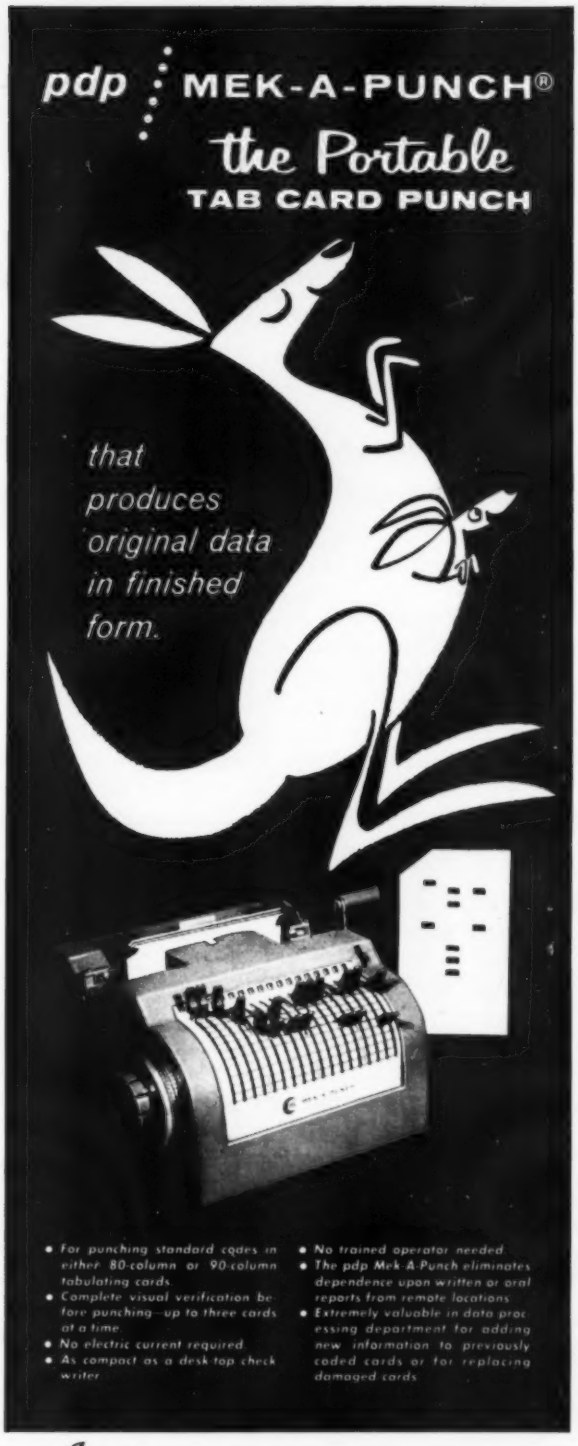
By now, Mr. Smith and I have agreed on the format of the report, the column headings, the number of totals, the abbreviations, and many other details. I come now to the part which is easiest, though often more time consuming: the physical preparation of the report.

There are many good ways of preparing a report. The best method will depend on the facilities available in your organization, together with the complexity of the report and the type of source data to be used. Regardless of the method involved, however, may it be manually, by electrical accounting machine, or by computer, the operations fall into four distinct steps:

1. Editing of vital parts of the information.
2. Selecting, and possibly reclassifying, the required information.
3. Sorting the accumulated information into report sequence.
4. Writing of the actual report.

When I hand the first report to Mr. Smith, my job is not quite complete. Of course, I will have made provisions for periodic preparation of the report. Aside from that, I should investigate whether this new report might not eliminate others now in use. Even after this is done, I must not rest on my laurels, or forget about the job.

Reports are images of an organization, and as an organization grows and changes, report requirements will. Every year I should knock at Mr. Smith's door and ask the all important question: "Does this report give you the information you need, when you need it?" ■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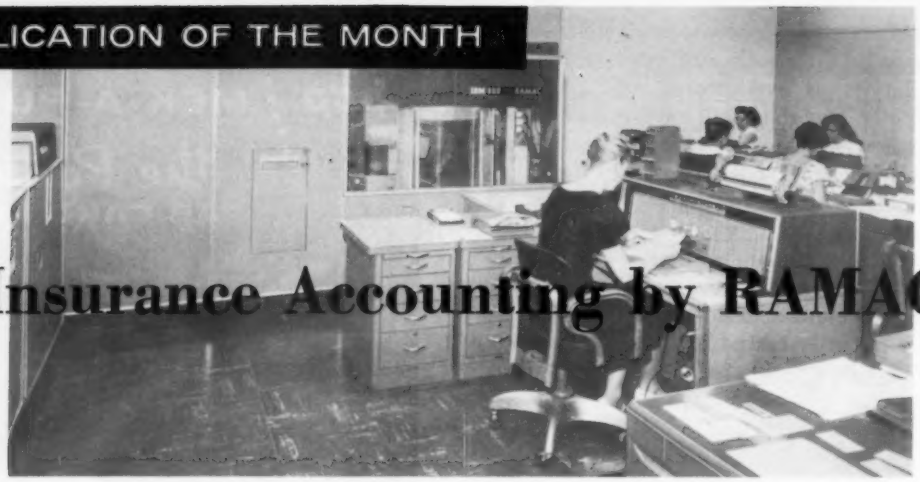
APPLICATION OF THE MONTH



Insurance Accounting by RAMAC

Proper balance of speed and capacity results in an effective system

By Bryson Clarke

OVER THE LAST FEW YEARS the Kansas City Fire and Marine Insurance Company, like many others, has given much thought to reducing expenses. The high cost of putting new business on the books, as well as high loss ratios, made it imperative that we do something to reduce costs in both areas. We have had punched card equipment for many years, and had enough machinery and people to grind out the reports our underwriting department wanted, but this method seemed expensive in our case. Since we wanted to reduce expenses and get our reports out on time, we had to look for another method.

When the IBM 305 RAMAC computer was announced, we immediately placed an order and started working on programs. In April, 1958, our first test revealed that we could not put everything we wanted into the machine, so we decided to leave out all bureau information and include only premium and loss figures for monthly statements and year-end reports.

File organization

Based on this decision, we organized our disk files as follows:

1. Located on disks 00 and 01, the risk state major line record contains risk state, major line, direct premiums, direct commission, assumed premiums, assumed commission, ceded premiums, ceded commission, direct paid losses, assumed paid losses, ceded paid losses, net original premiums and net expense.

2. Disks 03 through 13 contain the net inforce record. With four months per record, this includes major line, term, year, and direct, assumed, and ceded original premiums.

3. We have a special deck record on disks 19 through 22 which contains company number, major line, term, year, and ceded original premiums inforce for ten selected reinsurance companies, with figures for twelve months.

4. A record we call the Blasco, National Indemnity, and National Fire and Marine record is located on disks 15 through 18. For each of these agencies the disks store reinsurance agreement, major line, term, year, month and to date premiums, and original premiums.

5. The first half of disk 02 contains our gross pool record, showing twelve sets of monthly figures of reinsurance agreement, major line, term, year, and gross original premiums inforce to date.

6. Our reinsurance control, on disks 24 and 25, includes reinsurance agreement, major line group, monthly gross premiums, facultative reinsurance premiums, automatic reinsurance premiums, and net premiums.

7. Disks 26 through 29 hold a summary of reinsurance, subject to automatic treaties, gross premiums less facultative reinsurance. Organized by reinsurance agreement, the summary also includes risk state, term, expiration month and year, major line, premium and original premiums.

8. On disks 38 through 49 we have an agent's production record which contains the general agency, risk or agency state, agent number, production and transaction codes, the current month and year to date premiums, commissions and losses, and premiums and losses for the same period of the previous year.

With all of this information stored on disks, along with the necessary reference tables, we are able to punch out a very complete set of record cards. These records are essentially what we need and originally planned for. The system has been thoroughly tested, and has been operating since October 1, 1958.

System planned

Much has been said about electronic systems. Some have failed, and some have been highly successful. I think the difference between success and failure lies in planning and in selection of equipment. In our case success can be directly attributed to preliminary planning, to the untiring work of our programmers, and to the cooperation and technical help furnished by the equipment manufacturer. By the time the machine was delivered, our pre-installation work was complete and we were ready to use it. We are now studying a number of additional computer runs, including account checking and account differences, general ledger accounting, bureau calls and reports, rating of dwelling types of policies, and an accounts receivable application.

The 305 is designed to process and distribute items on a day to day basis, and is a fine machine when used this way. If input data are allowed to accumulate, the usefulness of the machine is hampered. We have one routine that loads at 400 cards an hour, and another that loads at 1,200 cards an hour. This isn't very fast, but the slow input speed can be justified by considering that the machine is distributing the information to many accounts and up-dating at the same time.

Controls

When we first installed the computer, we controlled each batch of cards by line, and separated the direct, assumed, and ceded to make certain our line and transaction distribution was correct. This was considered important because we group our detail line codes for annual statement purposes, and it might be possible to slip a cog somewhere along the line. This control is a must, and makes it easier to locate mistakes, which we have always been able to trace and correct. Don't get me wrong; the machine did what it was told to do, we just had a few little bugs in our programs that had to be put straight. No matter how many times programs are checked at the start of an operation, a few little things will turn up that have to be corrected.

At the end of the month, we bring out the necessary premium and loss figures that are used in the profit and loss statement. It takes 33½ hours to unload all records and punch a card on each item. We bring each record off in the right sequence by sorting our address cards as required by the finished report. Once the record is out of the 305 all that is necessary is to list the report in final form — no sorting is required.

The computer is accurate and reasonably trouble free. The full effect of having the 305 is still to be felt in our company. We think we will be able to cut additional equipment as more applications are adapted to the machine. ■

Coming Events

OCT. 2-4
IRE 7th National Communications Symposium.
Utica, N. Y.
Contact: R. K. Walker, 34 Bolton Rd., New Hartford, N. Y.

OCT. 2-4
IRE Canadian Electronics Conference.
Automotive Bldg., Exhibition Park, Toronto, Canada.
Contact: A. R. Low, c/o Canadian Electronics Conference, 1819 Yonge St., Toronto, Ontario, Canada.

OCT. 4-12
Electronic Computer Exhibition.
London, England.

OCT. 8-11
Systems and Procedures Association 14th Annual International Systems Meeting.
Statler-Hilton Hotel, Cleveland, Ohio.
Contact: Mr. Lawrence E. Melick, Sec. 1961 ISM, c/o Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio.

OCT. 9-11
NOMA National Office Exposition.
Philadelphia, Pa.

OCT. 9-11
IRE, AIEE National Electronics Conference.
International Amphitheatre, Chicago, Ill.
Contact: Dr. William L. Firestone, Motorola Inc., Chicago, Ill.

(continued on page 50)

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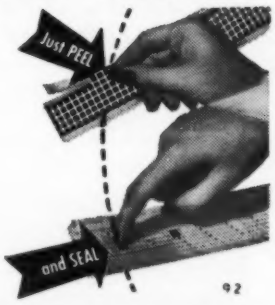

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Marien on FORMS —A Monthly Feature

RAY MARIEN

The Bootlegger

FORMS CONTROL has done more to revive the word "bootlegger" than any ten movies about the "Roaring Twenties." A word that is thrown into most every forms control sales pitch, it has been bandied about so much that it's part of every forms man's vocabulary. Naturally, they are not talking about "stuff right off the boat." They use the word in connection with forms — *bootleg forms.*

It refers to the office form that arises mysteriously from the depths of someone's typewriter, is smuggled in and out of the duplicating department, and ends up in illegal (unsanctioned) use in someone's paperwork dynasty. The supposition is that bootleg forms *create* jobs. One theory declares that if 20 forms are bootlegged, they will result in the need for one full-time clerk, merely to fill them in and process them. Thus—a *job* has been created.

Forms control is supposed to choke off the bootlegger by setting up one central point for the authorization of forms printing. When a competent forms analyst is asked to create a new form or revise an existing one, he first determines the *need* for it. In that way, many forms never get reprinted, as they are found to be totally unnecessary in the first place. The bootlegger thereby is soon supposed to be forced out of business and must look for some other nefarious way of adding to office costs. (Throwing paper clips out the window or taking ballpoint pens home to the kiddies are two popular substitutes!)

When the forms control disciple tells you that forms control will eliminate bootleg forms, don't believe him — *entirely.* Of course, the strict adherence to procedure for forms creation and procurement will shut the door on the bootleggers. But, being slippery characters, they'll find another way in, perhaps by the window. For if someone *really* wants to produce a form of his own, it is exceedingly difficult to stop him!

Let's track down a typical bootlegger and watch his *modus operandi.* He begins by being clever and *eliminating* work. He finds that one of his clerical chores would be simpler if he had a form to help him, instead of repeatedly re-writing the same constant information time after time. So he designs one. Then he types it up and draws in the lines. Usually he resorts to hectograph or stencil masters which can be run off on a handy duplicator in his department. After it has been run off, he clutches his masterpiece in his hot little hands and strolls back to his desk, feeling he has really *done* something for his company.

He has — but not in a positive sense! He's produced negative results. First off, the form he designed is usually a bungled mish-mash that's difficult to fill in and puzzling to everyone, including himself. Next, the run, if on hectograph, will give him only a couple of hundred copies and he'll have to prepare a *new* master before he realizes it. The whole routine starts all over again, and it's *needless* because an offset plate would give him a year's supply at one run!

The big trouble with the bootlegger is that he quickly convinces himself that he's benefiting the company by his handiwork, so he's always ready to create another form. Soon, he's surrounded by his own works-of-art, and so are other people that he has "helped out."

None of those forms have been properly designed. None have been thoroughly investigated as to their need or value. None have been produced or procured efficiently or economically. It all adds up to waste and useless activity on the part of many people.

Forms control tries to put a lock on the bootlegger by choking off his source of reproduction. They usually work together with the duplicating machine operators to forestall any printing of anything resembling a form *unless* it has been previously cleared with the forms control department.

Obviously, this "lock" is not too effective where unsupervised duplicating equipment is concerned. Many departments are big enough to have their own hectograph, stencil-type or offset duplicator. That is where the bootlegger is most difficult to stop. The only ready answer to that situation is to have the department head keep a closer watch on the output of his duplicating equipment, and back that up by periodic spot checks and visits from the forms analysts.

Another method involves occasional forms collections in those departments suspected of harboring bootleggers. Try as hard as you might, however, the bootlegger *will* survive. In the office forms field at least, it appears he may *never* be completely eliminated.

■

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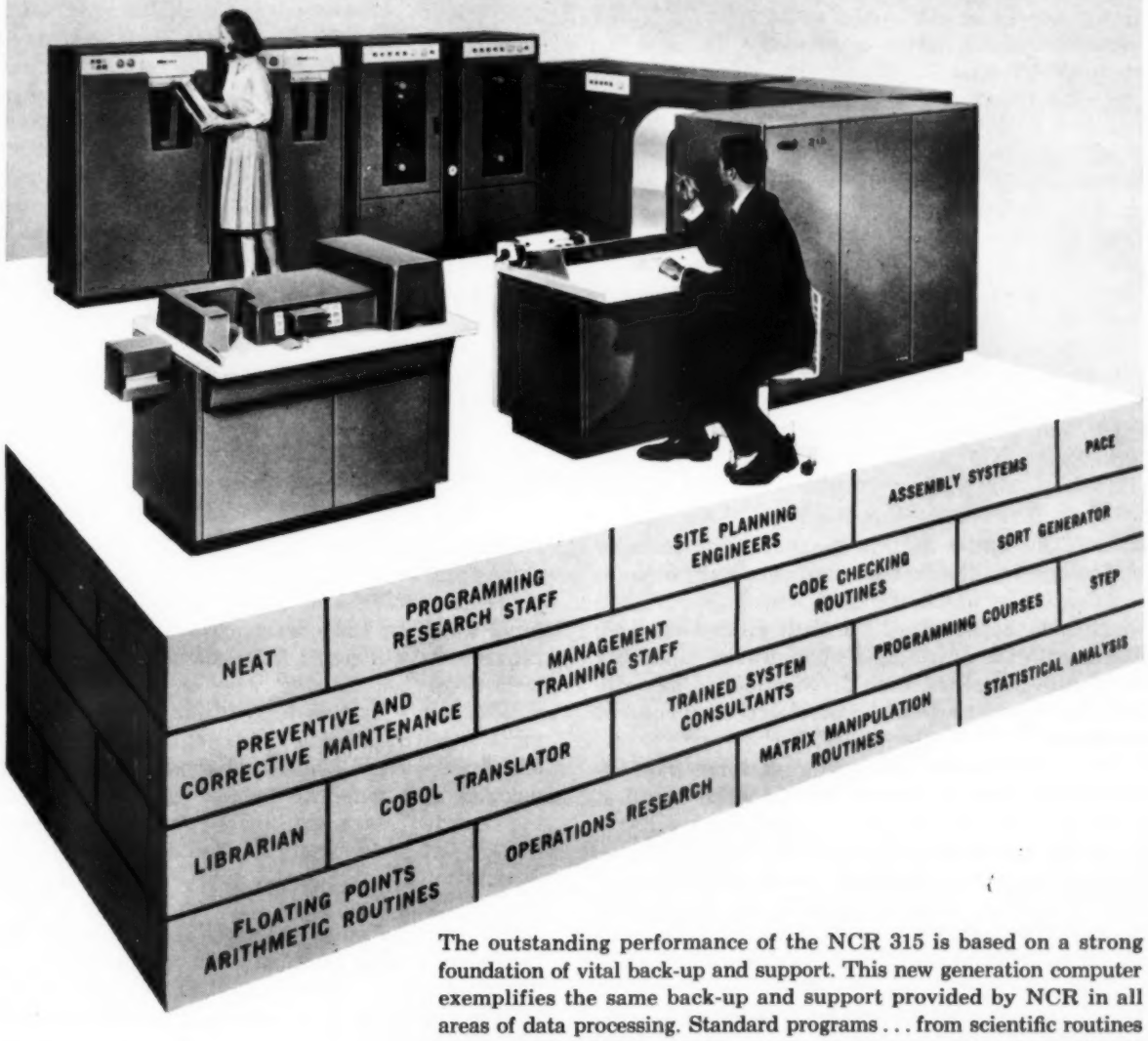

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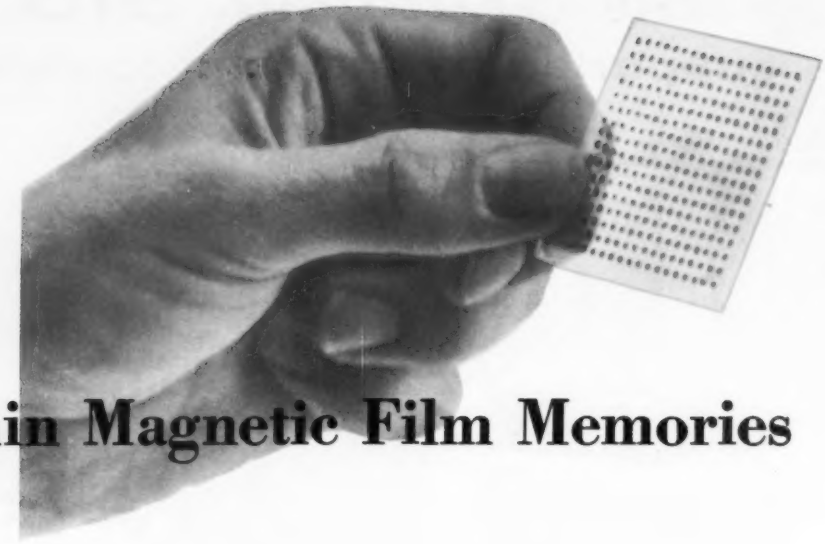
By E. W. Pugh and W. E. Proebster



Thin Magnetic Film Memories

Their role in future computers

RECENT ADVANCES in thin magnetic film memory technology for high speed computers have brought to attention again the rapid technological progress which has characterized the data processing field. Along with the advantages of improved capability for future machines, each forward stride has also brought with it problems of obsolescence in current machines.

The capabilities of computing machines have increased by several factors of ten since the first large scale digital computing systems were introduced for the solution of scientific problems only 20 years ago. The speeds of these early machines were limited by mechanical motions involved in input-output operations and by the electromechanical relays used in performing arithmetic, storage, and transfer operations. Simple operations of addition and subtraction required more than one-tenth of a second. The first step toward truly high speed computers occurred when relays were replaced by vacuum tubes in the late 1940's. The replacement of vacuum tubes in the 1950's by solid state devices such as transistors, along with the introduction of ferrite cores, magnetic tape, etc., brought further advances in speed and reliability. Addition and subtraction can now be performed in less than one millionth of a second, and the improvement over the electromechanical machines is even more striking when complex operations such as matrix inversion are considered.

Such rapid improvement in machine performance cannot be expected to continue indefinitely. However, current laboratory studies indicate that a significant rate of improvement in future machines can be anticipated for some time. Some improvement will result from changes in programming and machine organization, while other improvements will result from the utilization of new technologies. Promising new technologies under serious study at this time include magnetic thin films, superconducting thin films, tunnel diodes, and microwaves. While any or all of these technologies may make an impact on the market in the next ten years, thin magnetic films have been the longest under study in numerous laboratories throughout the world and appear to be closest to commercial utilization.

The purpose of this article is to acquaint the reader with some basic concepts of thin film memory construction and operation as well as to evaluate the short and long term potential of thin film memories and their possible effect on the obsolescence rate of present data processing equipment.

Thin film memory operation

The operation of a thin magnetic film memory array is similar in principle to that of a random access ferrite toroid memory. In a ferrite memory (consisting of thousands of small ferromagnetic donuts — or toroids), each toroid stores information by the sense of its magnetization. In standard parlance, a "one" may be said to be stored when the toroid is magnetized clockwise while counter clockwise magnetization may correspond to a "zero." By using suitable coding techniques, it is

possible to represent a wide range of information by the pattern of ones and zeros so stored in the memory array.

In a thin film array, the toroids are replaced by an array of thin metallic spots which typically are made of permalloy (a ferromagnetic alloy of nickel and iron) and may be rectangular with dimensions of less than 0.04 inch on a side and four millionths of an inch thick. These metallic spots are in fact thinner than the paint on an automobile and must be supported in the memory by being placed on a substrate plane such as glass or mica. Usually these spots are evaporated onto the substrate in an evacuated chamber containing a heated crucible of permalloy, as illustrated in **Figure 1.** As the crucible is heated above the melting point of the metal, the metal evaporates from the crucible and deposits in a thin film over all the walls of the evaporation chamber as well as on the surface of the substrate which is placed in the chamber. Individual spots may be formed by evaporating metal onto the substrate through a suitable mask or by completely covering the substrate with a film and then etching away the unwanted material about the spots. Films are generally deposited in a magnetic field, as illustrated, in order to achieve two oppositely directed stable directions for the magnetization. If these directions correspond to a magnetization to the right (north poles to the right and south poles to the left) or magnetization to the left, then a one or zero may be designated by the right or left handed sense of the magnetization; and the magnetic field induced by electric current in a nearby wire or wires can be used to change the direction of magnetization from a one to a zero or vice versa.

A three by four array of these bits is shown in **Figure 2,** together with electric current carrying loops required for performing read-write operations. Each loop — W1, W2, W3, and W4 — links a group of film bits called a word, and the address of any one bit is fully specified by designating the word and bit loops which pass around it, such as W2-B3. Information is read out of an entire word at a time by passing a current pulse through a word loop, for example, W1. This current creates a magnetic field, at each bit traversed by the loop, which is perpendicular to the W loop and thus perpendicular to the direction of magnetization in the bit. The magnetization of the film is rotated into the direction of the applied field, and the direction of rotation is either clockwise or counter clockwise depending upon whether a one or zero was originally stored. A positive or negative voltage induced in the B lines by the clockwise or counter clockwise rotation of the magnetization is used to determine the original direction of magnetization of each bit in the selected word. To write information into the bits lying along line W1, a current pulse is sent through each of the B loops. These currents create magnetic fields, at the bits, which are perpendicular to the B lines and thus parallel to the easy axes of the films. Whether each of these fields is directed to the right or left depends upon whether the current in a particular B line is of positive or negative sign. In any event, these fields are too small, by themselves, to reverse the magnetization in any of the films. However, if a sufficiently large current pulse is simultaneously sent through the line W1, a field perpendicular to line W1 and to the easy axes of the films results which rotates the magnetization into the

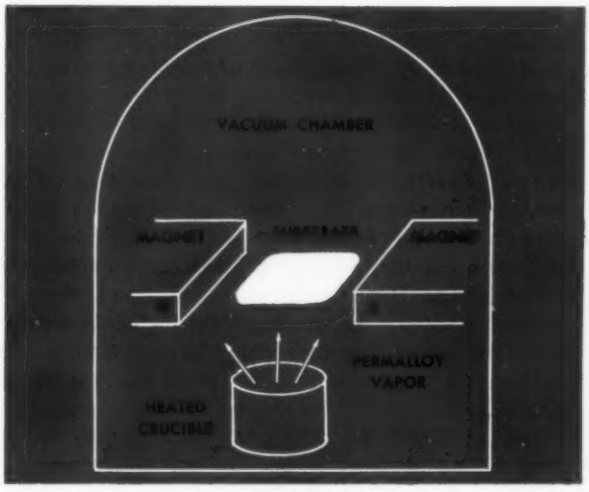


FIGURE 1

Schematic illustration of vacuum chamber used for evaporating a permalloy film onto a substrate plane. The magnetic field between the N and S poles of the magnet is used during the film evaporation to create an easy direction for magnetization in the film.

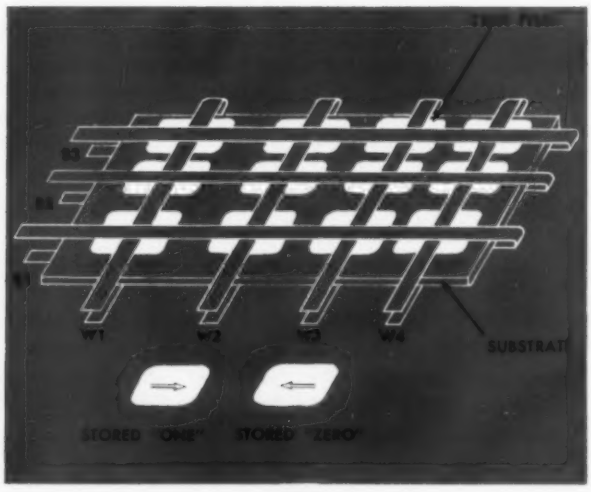


FIGURE 2

A typical three by four array of thin films on a substrate is shown with bit and word loops for the read-write operation. Film number B3-W2 is indicated by the arrow labeled "thin film." The direction of magnetization corresponding to a "one" or "zero" is shown in the two films not in the array.

hard direction. When this current through line W1 is stopped, the magnetization in each film rotates back into the easy axis — its rotation to the right or the left being determined by the direction of the field of the B line.

Comparison with ferrite cores

Ever since thin film memories were first proposed by Blois and Conger in 1955, it has been recognized that such memories possess a number of inherent advantages. These include high speed operation, low current requirements and small energy dissipation, effective cooling, fabrication of entire arrays at once instead of individual bits, high density of memory elements, and the possibility of utilizing simple printed wiring techniques instead of threading wires through individual bits as is done for ferrite cores. Considerable development work must yet be done, however, to exploit the full potential of thin film memories. This is clearly evidenced by the fact that thin film memories with read-write cycle times of 500 nanoseconds (one nanosecond equals one billionth of a second) are just beginning to reach the development stage, while switching times for individual thin film elements of less than two nanoseconds have been observed for more than two years.

The first thin film memory reported in operation is a 32 word, 10 bit per word memory associated with the M.I.T. Lincoln Laboratory TX-2 computer. This memory has been in operation since July, 1959, at a read-write cycle time of 800 nanoseconds, and is reported to be capable of operating at cycle times as short as 400 nanoseconds. The first commercial thin film memory is a 128 word, 36 bit per word memory to be delivered with the Sperry Rand 1107 computer. The anticipated cycle time of this memory is approximately 600 nanoseconds. While these memories represent remarkable engineering achievements, they are smaller than most ferrite core memories which typically contain 100,000 to 1,000,000 bits. They are slightly faster but have considerably less capacity than the fastest ferrite core memory now in operation in a computing system.

This comparison is not altogether fair, however, since the core technology has been under study for some five to ten years longer than the film technology. The comparison does, however, suggest that, together with the predicted advantages of thin films, there are a number of engineering problems. Among these problems are the difficulty of fabricating large arrays of films with each film meeting the required specifications, the difficulty of detecting the small voltages produced by the reversal of magnetization in the thin films, and the difficulty of making transistors and circuits capable of handling the speeds inherently available in the magnetic films.

In addition to these problems, peculiar to magnetic film memories, all memory technology will soon be limited by the finite velocity of electric current propagation which cannot exceed the velocity of light. Consider, for example, a 1,000 word thin film or ferrite core memory in which the bits are spaced 20 to the inch. The minimum length of the word and bit lines is thus 50 inches and a current pulse will require more than five nanoseconds merely to get from one end of the memory to the other! This neglects entirely the length of lines outside the memory which would have to be even longer than this, and it does not consider the time for any of the components to react to the current signals. This clearly illustrates one reason why large capacity memories will always have relatively longer cycle times than can be achieved with smaller memories. While cycle times considerably less than 500 nanoseconds will certainly be possible for memories of reasonable size, it is unrealistic to consider thin magnetic film memories with cycle times less than a few nanoseconds.

The relative costs of fully wired thin film arrays and ferrite core arrays are difficult to compare because of the very limited production experience available for thin films. However, preliminary information suggests that the cost per bit of the fully wired thin film memory (excluding drive and sense circuitry) will be a few cents per bit, which is very similar to the cost per bit of ferrite core memories.

The future of thin film memories

While present thin film memories are faster than core memories, it is anticipated that in the next few years small thin film memories operating at 100 nanoseconds or faster will be built. Such speeds are faster than can be achieved conveniently by core technology. These small film memories will be used in conjunction with larger ferrite memories much as ferrite memories are now used to perform high speed operations in conjunction with the larger capacity tape, drum, and disk files. It is doubtful, however, that thin film memories large enough to replace the large and very reliable ferrite memories will be available within the next five to ten years. During this period of time, the net improvement in machine performance resulting from the use of thin film memories is not expected to reach a factor of ten or even five for most applications.

Beyond five to ten years, the relative position of thin film and ferrite core memories is hard to predict, and one must always keep in mind the fact that development of superconducting thin film devices, tunnel diodes, microwave devices, or the development of technologies not yet under laboratory study may hold in store even more exciting advances for computers of the future. ■

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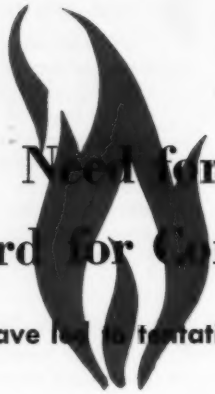
By Edith Harwith Goodman



Need for Fire Standard for Computer Areas

Some fires which have led to tentative standard adoption

ALTHOUGH July 2, 1959 marks the beginning of public awareness that fire is a great hazard in computer areas, the problem had existed before the dramatization in the national press of the nearly $7 million Pentagon computer room fire. (This shocking figure does not include the cost of rebuilding vital records lost from thousands of damaged tapes.) Computer manufacturers were struggling with a patchwork of local fire codes across the country as they made installations.

Some fire reports from the files of the National Fire Protection Association show the monetary loss and causes of computer involved fires (not a complete report), and the need for adequate protection in all installations.

In Kingston, New York, on March 3, 1959, a fire occurred in an electronic equipment manufacturing building which caused $500 worth of damage. The fire was in the testing room, which was of noncombustible construction except for the raised wooden floor. The room, as well as the space under the floor, was sprinklered. A resistor short circuit in a computer involved seven plug-in type units. The units were unplugged and all fire put out by extinguishers.

On May 14, 1959 at Yellow Spring, Ohio, there was $218,000 fire damage at a college laboratory caused by a fire of unknown cause. The fire, which originated in a storage area in the attic of an unsprinklered four story, brick, concrete floored building, burned out part of the attic and wooden roof before extinguishment. About $120,000 damage occurred to a government owned computer.

In Laurel, Maryland, a government office building sustained $393,000 damage plus computer machine damage on June 13, 1959. The fire was caused by a lightning stroke which involved a basement computer machine room in an unsprinklered two story and attic, brick-wood-floored building. Installation personnel attacked the fire with extinguishers and standpipe hose lines and were aided by four outside fire companies. Six computers were a total loss and many records, tapes, etc., were damaged or destroyed.

Very expensive

There was $6,690,000 involved in the July 2, 1959 fire at Arlington, Virginia, in a government office building. This fire originated in an area used for storage of computer plastic tapes in plastic containers on open metal shelving in an unsprinklered, fire resistive, multi-story building honeycombed with combustible wood framed partitions and ceilings forming concealed spaces. Three computing machines on a raised wooden platform were also involved in the fire and were seriously damaged or destroyed. The fire, thought to have been caused by heat from a 100-watt incandescent electric lamp becoming wedged between a metal shelf top and the combustible ceiling, was extinguished with large hose streams used by two public fire departments and a government fire department.

On July 3, 1959, at Sault Ste. Marie, Ontario, an office building had a $76,000 fire. Corrosive compounds formed in the breakdown of a halogenated refrigerant were the cause of complete damage to an expensive accounting machine. This interesting case was initiated when fire broke out in a newly installed five-ton package air conditioner located within the unsprinklered enclosed machine area. While the details of the fire cause are unknown, it is known that the plastic filters of the air conditioner were somehow ignited. An intense fire fed by the plastic filters developed within the air conditioner itself. The exposed cooling coil was heated to the point where the fusible plug operated, releasing the refrigerant. The destructive acid compounds released by the breakdown of the halogenated refrigerant under the action of the fire's heat spread out in the machine area. Not only were the electronic components of the machine irreparably damaged but the metal furniture and window frames were etched as well. Damage to the accounting machine was estimated to be $70,000.

At Endicott, New York, on July 7, 1959, there was $100 worth of damage at an electronic equipment manufacturing building. Fire occurred in the computer manufacturer's testing room as wiring to a transformer in the power supply flared

up when the computer was plugged in. The operator pulled the plug and extinguished the fire with extinguisher before sprinklers opened.

Eight hundred dollars fire damage occurred at Kingston, New York, on August 28, 1959, at an electronic equipment manufacturing building. A computer, which had been in use for several years, caught fire when a plastic shield, installed too close to power-pack contact relay, ignited from radiant heat. This shield had been added to the machine at some unspecified time during its use. The fire was quenched by an extinguisher before sprinklers opened.

At an airline office building in Miami, Florida, $900 fire damage was suffered on November 2, 1959. Smoke was noted coming from a collator machine in an unsprinklered, noncombustible building. The unit was idling at the time. Removing the back cover, the operator blew out the small flame which he noted but which subsequently flared up again. A soda-acid fire extinguisher was then used on the unit, the liquid from which put out the fire but damaged several relays.

October 3, 1960 at Vicksburg, Mississippi, there was fire damage to the amount of $1,349,000 in a government office building. The fire was of unknown origin and destroyed the greater part of the rambling, unsprinklered two story and attic office building having sheetrock on steel frame walls and wood joisted floors and roof. Lack of automatic sprinklers, adequate fire cut-offs, and the large amount of combustible contents were factors in the rapid spread of fire. Included in the contents loss was an electronic computer valued at $400,000, as well as many records, drawings, library, printing and photography equipment, etc.

At Cambridge, Massachusetts, a fire occurred on March 19, 1961 which caused $30,000 damage at a university. The fire started from ignition by heat of carbonized wood in a power-pack enclosure of a digital and analog computer, the equipment having been continuously energized over several years. The fire was discovered and extinguished by a watchman using extinguishers and a small hose line with spray nozzle before sprinklers opened. Fire was confined to the unit where practically all the damage occurred, but the project for which it was used was held up for three or four months until a replacement computer could be obtained.

NFPA acts

Finally, at the request of the beleagured computer manufacturers that some sort of order be made out of the chaos of fire codes, the National Fire Protection Association formed the NFPA Committee on Electronic Computers Systems to devise a comprehensive code as a national standard for computer area fire safety.

Meeting in Detroit in May, 1961, the NFPA adopted a tentative standard as presented by the committee chairman, John J. Ahern. The tentative standard, a committee working paper, will be revised during this coming year and a permanent standard will be presented for adoption at the NFPA meeting at Philadelphia in May, 1962.

The tentative standard covers such areas as general computer room requirements, building construction requirements, construction of computer equipment, protection of computer rooms and equipment, record protection, utilities, fire emergency procedures, and a glossary of terms.

This standard is available in pamphlet form (NFPA No. 75-T) for 50 cents from the National Fire Protection Association, 80 Batterymarch Street, Boston 10, Massachusetts. Everyone concerned with a computer installation should send for this booklet and read the proposed recommendations for fire safety.

The Committee on Electronic Computer Systems urges that all who have ideas, criticism, and suggestions relating to the tentative standard communicate with the chairman, John J. Ahern, 13-205 General Motors Building, Detroit 2, Michigan, by October 1, 1961. Mr. Ahern is the Director of Security for General Motors and has long been involved in fire safety activities. ■

SEEN IN PRINT

APPLYING COMPUTERS TO ROUTINE SYSTEMS, by Monroe Koontz. Industrial Management Society: IMS Clinic Proceedings, 1960.

Paperwork growth cannot be viewed in a vacuum, but is caused by and is partly responsible for a huge growth in industrial productivity. In considering a paperwork system, and evaluating possible equipment uses, it is necessary to consider whether the system will aid in this productivity by producing good information in usable form which will improve operations. Good information requires careful procedures, checks, and personnel training to eliminate errors. Information form and content may be improved through a systems approach and development of by-product reports. Integration and speed help make the information capable of improving the company's operations.

A SYNTAX DIRECTED COMPILER FOR ALGOL 60, by Edgar T. Irons. **Communications of the ACM.** Vol. 4, No. 1. January, 1961.

Besides translating an object language into a target language, a compiler defines the object

(continued on next page)

language in terms of the target language. The meta language used in the defining process is described fully. The major restriction necessary for the process is that there be a unique syntactic structure for any possible finite string of symbols. Essentially the process simultaneously diagrams a string of symbols according to syntax and keeps track of the meaning. The translator which operates on the object language can operate on any object language that is described by the syntax. The system described has been used on a Control Data Corporation 1604 computer. A complete description and examples of the process are given.

THE CLIP TRANSLATOR, by Donald Englund and Ellen Clark. **Communications of the ACM.** Vol. 4, No. 1. January, 1961.

CLIP is a language and compiler (generator and translator) for use with the IBM 709 computer. The language is similar to ALGOL; its differences are enumerated. The language allows for processing information packed into part words, thereby conserving space. The translator generates: 1) storage allocations, making use of SMASHT for storage of constants; and 2) instructions, by sequentially processing an intermediate language produced by the analysis phase of the compiler. The article also includes a description of the tables generated and a short discussion of the status of CLIP.

MORE VALUE FROM PERSONNEL TESTING, by Andrew H. Souerwine. **Harvard Business Review.** March, April, 1961.

Management atmosphere, attitudes, and value judgments have much to do with the success or failure of a testing program. The usual criteria for determining the need or usefulness of a testing program — defining a personnel problem, finding tests which may solve the problem, determining how much the program will cost and its effects on the labor supply, etc.—are necessary but incomplete. The author further states that management must also re-examine its departmental relations, its attitudes about people, its attitude toward objective personnel measurement, and its feelings about change. The introduction of a testing program means a long term effort, and will have definite effects on management, employees, unions, and job applicants. The subtleties of the human element will in the long run exert more influence on the program than the mechanics or statistical efficiency of the tests themselves. ■

66 NOTABLE QUOTES

"The popularity of management games is not to be denied, and their ultimate usefulness may be great. However, their present validity for management training is widely questioned, and for testing unanimously challenged. Functional and specialized games, which are closely related to specific jobs or to particular companies or industries, seem to offer more promise for training than do general management games. No game, however, is better than the staff that conducts it, nor than the total course of which it must still be only a minor part."

Charles E. Redfield, *Should Business Men Play Management Games?* **The Office,** June, 1961.

"Current use of the term 'data processing' has tended to restrict the term to a narrower concept than actually exists. This is unfortunate because to confine the term to mechanical or electronic methods only, greatly delimits the concept of data processing operations in business firms. The activities comprising data processing in business firms include collecting and receiving information, classifying information according to purpose and ultimate use, recording data, analyzing and treating data so they will be more useful and understandable, storing data, and eventually making data available either as isolated facts or in report form to both internal and external personnel or agencies.

"The concept of data processing therefore is broad in scope. In short, data processing may be defined as any act which may be done to data, performed with data, which stems from the possession of data, or which deals with the manipulation of data."

Loren E. Waltz, *How Business Uses Processed Data,* **Journal of Business Education,** April, 1961.

"The designer of computers sometimes feels like a mountain climber threatened by an avalanche of his own making. In this case it is an avalanche of numbers. Each advance in the art of high speed computers has loosed a rush of numerical data and new problems from science, engineering and business. To take one example, solid state physicists can now attack certain important questions concerning diffusion that they could not have touched a few years ago. To solve such problems, however, requires several months of continuous running time on a large computer. To keep pace with the mounting demand it will soon be necessary to have computers with hundreds — even thousands — of times the capacity of the huge machines now in existence. It is probably not an exaggeration to say that the present rate of scientific and technological progress will not be maintained unless such computers are developed."

William B. Ittner III and C. J. Kraus, *Superconducting Computers,* **Scientific American,** July, 1961.

99

PRODUCTS SERVICES

FILE-A-TAB

Visual Controls Company has two new punched card filing aids which can be used to store control cards, "made over" cards, and other small groups of cards in the computer or punched card room. Called File-a-Tab packets and boards, the card holders have pressure sensitive backs. Light pressure will cause the packets to adhere temporarily to a flat surface such as a table top or wall, in which case they may be relocated many times. Either the packets or the boards may be attached permanently to any vertical or horizontal flat surface by applying a firm pressure. A File-a-Tab board is constructed of aluminum and has room for eight packets. The packets stick to the board; the board sticks to the wall or other surface.

Circle no. 40 on reader service card.

PROGRAMMER APTITUDE TESTER

Wolf Research and Development Corporation has programmed a computer to test computer programmers. Their Programmer Aptitude Tester (PAT) is a multiple choice aptitude test which has been programmed for a Bendix G-15D computer. The test can be programmed for other computers also.

Using the G-15D, the applicant uses the console typewriter to record his answer to a question on one of a set of cards. The program causes the computer to compare the typed answer with an answer table and record whether the answer was right or wrong. The computer also times each question. After one question has been answered, the number of the next question card is typed out on the console typewriter and the computer begins keeping track of the time until the applicant types his answer.

As soon as the test is completed the program causes the G-15D to furnish a raw score (number right minus ¼ number wrong), time-adjusted score, mean time per question, and actual time (in seconds) and mark for each question.

Circle no. 41 on reader service card.

UTILITY BILLING PROGRAM

About 40,000 instructions make up IBM's Symbolic Utilities Revenue Environment (SURE) program, a generalized utility billing routine available for the IBM 7070 and 7074 computers. The program is also being written for 1401 and 1410 systems. The basic SURE program is adapted for a specific company by writing in the utility's rate structure, billing cycle and other characteristics.

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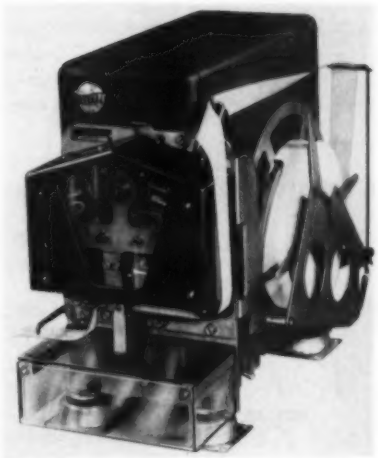
IBM 7080 NOW 15% FASTER

Two standard improvements by IBM have uprated the internal speed of the 7080 by about 15 per cent. The cycle time of the central processing unit has been reduced from 1.09 to 1.00 microsecond. Access time in the 1,024 position input/output exchange has thereby also been reduced from 1.09 to 1 microsecond, and access time of the main core memory of 80,000 or 160,000 positions has been reduced from 2.18 to 2.00 microseconds. Also, a Ten Character Transmit instruction has been added to make transfers possible in blocks of ten characters instead of five.

Circle no. 43 on reader service card.

TELETYPE TAPE UNITS

Teletype Corporation has two new 100 character a second paper tape units, the BRPE tape punch and the CX tape reader. They may be used with each other in a data transmission system or as input/output devices in a computer system. Both



units normally operate on parallel wire impulses, but they can be adapted for use with standard telephone lines. Either unit is available for 5, 6, 7 or 8 channel tape. The BRPE is 12 inches high, 8 inches wide and 16½ inches deep, and weighs 28 pounds. The CX is 5 inches high, 6 inches wide and 11 inches deep, and weighs 12 pounds.

Circle no. 44 on reader service card.

PHILCO MANAGEMENT SEMINARS

A bi-monthly series of management seminars titled an Introduction to Data Processing will be held at the Willow Grove plant, Computer Division, Philco Corporation, from June through December 1961. There is no charge for attendance at these sessions.

Circle no. 45 on reader service card.

BOUND PROCEDURES

Pro-Forms Company has expanded its stock of procedure forms, originally designed for use with IBM punched card equipment, to include computers and magnetic tape systems. Data processing procedure sets can be tailored from a stock of half a million forms covering 1,000 machine procedures. The sets are bound in General Binding Corporation covers.

The procedure sheets themselves are printed on 6¼ by 8½ inch heavy paper stock, a size found most usable around the machine room. The GBC covers are 9 by 7 inches and may be embossed on GBC equipment with information such as company name, application, and procedure number. Individual sheets, each representing one step in the procedure, may be inserted or removed from the covers as required, but are otherwise held fast through a 14-hole attachment.

Circle no. 46 on reader service card.

Typical of the Pro-Forms Company procedures manual, used to instruct a company's electronic data processing equipment operators, is this procedure booklet. Using General Binding Corporation equipment, each booklet can be customized for individual needs of customer firms.

BANKERS BUSINESS SERVICE

Cummins-Chicago Corporation has field tested an operation called Bankers Business Service and is now offering the service nationally. Eastern Michigan banks with as few as 50 instalment accounts are now using the service. The service is designed for low volume instalment credit operations, requires no equipment investment, and is paid for at a flat rate per account.

Circle no. 47 on reader service card.

TECHNICAL BOOKSTORE

The McGraw-Hill Book Company has opened a technical bookstore in the lobby of its New York office, at 330 West 42nd, carrying engineering, scientific and business books of all publishers in the United States. The store's coverage aims at eventually including all such publishers throughout the world. The initial stock is 12,000 titles, arranged by subject in reference library fashion in a 6,000 square foot area.

Circle no. 48 on reader service card.

(continued from page 39)

Coming Events

OCT. 10 - 12
American Standards Association 12th National Conference on Standards.
Houston, Texas
Contact: ASA, 10 E. 40th Street, New York 16, N. Y.

OCT. 10 - 13
USE Meeting. Warwick Hotel, Philadelphia, Pa.
Contact: J. W. Nickitas, Sec. USE, Univac Division, Sperry Rand Corporation, 315 Park Avenue South, New York 10, N. Y.

OCT. 11 - 13
System Development Corporation and Office of Naval Research co-sponsored Conference on "Application of Digital Computers to Automated Instruction".
Department of Interior Auditorium, C Street between 18th and 19th Sts., N.W., Washington, D. C.
Contact: Washington Liaison Office, SDC, 1725 Eye Street, N.W., Washington 6, D. C.

OCT. 12 - 13
Univac Users Association Fall Conference.
Warwick Hotel, Philadelphia, Pa.
Contact: Walter Edmiston, Sec. Univac Users Association, Philadelphia Naval Shipyard, Philadelphia 12, Pa.

OCT. 12 - 13
NMAA 3rd Annual Division 5 Conference.
Marott Hotel, Indianapolis, Ind.
Contact: NMAA Conference, P.O. Box 256, Indianapolis 4, Ind.

OCT. 16
Association of Data Processing Service Organizations West Coast Management Symposium.
Ambassador Hotel, Los Angeles, Calif.
Contact: W. H. Evans, Exec. Vice Pres. ADAPSO, 1000 Highland Ave., Abington, Pa.

OCT. 16 - 17
PGEWS National Symposium on Engineering Writing and Speech.
Kellogg Center of Cont'd. Education, Michigan State University, East Lansing, Mich.
Contact: J. D. Chapline, Philco Corporation, 3900 Welsh Rd., Willow Grove, Pa.

OCT. 23 - 26
National Business Forms Associates Convention.
The Americana Hotel, Bal Harbour, Fla.

OCT. 23 - 27
National Business Show.
Coliseum, New York, N. Y.

OCT. 24 - 25
Computer Applications Symposium sponsored by Armour Research Foundation.
Terrace Casino, Morrison Hotel, Chicago, Ill.
Contact: Robert B. Brausch, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

MOBILE PERFORATOR

American Printing Equipment and Supply Company is marketing a British-made machine which perforates, creases and slits paper, covers, cardboard and other materials up to ⅛ inch thick. Called the Rollem Mobile Perforator, the unit is set on heavy casters.

Circle no. 49 on reader service card.

FILMAC 300

The Filmac 300 is a new microfilm reader/printer marketed by Microfilm Products Division, Minnesota Mining and Manufacturing Company. The unit accepts either 16 or 35 mm. microfilm in roll, aperture card, jacket or film sheet form, and makes copies of up to 11 by 14 inches with magnification of 8 to 20 diameters.

The unit is 26 inches high, 21½ inches wide and 46 inches deep, weighs 220 pounds, and requires 110-120 volts, 15 amp AC power. The price, installed, is $3,600.

Circle no. 50 on reader service card.

G-20 NOW FASTER

Bendix has updated its G-20 computer's maximum input/output speed to 480,000 characters a second by means of the DC-11 data communicator. The DC-11 has four data channels, each capable of relaying information between the G-20 central processor and a number of different input/output devices, and is available as a basic accessory to the computer.

Circle no. 51 on reader service card.

H800 PROGRAMMING AIDS

Minneapolis-Honeywell is delivering two programming aids to Honeywell 800 customers. The Program Test System is used for automatic test runs of several programs at a time without manual intervention. The Executive System is used to schedule and monitor a series of production programs being run during the same time period on the 800.

Circle no. 52 on reader service card.

MATRIX SUBROUTINES

Philco has a number of subroutines, written in TAC language, for performing matrix operations on its 2000 computer. The library of matrix routines includes matrix ad-

(continued on next page)

A single machine that applies all types of address labels?

Wide-strip, narrow-strip, continuous pack form, cut or individual labels! All applied automatically to a wide range of printed pieces at cost-cutting high speeds (up to 16,000 per hour). No matter whether labels are pre-addressed from punched cards, magnetic tapes, plates, stencils or other addressing systems. Or whether you mail small postcards and envelopes . . . middle-sized pamphlets and brochures . . . or larger magazines, catalogs and quarter-fold tabloids. All handled by the compact easy-to-operate **Cheshire Model E.**

CHESHIRE INCORPORATED

Write for descriptive brochure.

Dept. DP-9, 1644 N. Honore Street, Chicago 22, Illinois

Circle no. 14 on reader service card.

dition, subtraction, transposition, and inversion. Also available are routines for eigenvalue and eigenvector computation and a newly developed linear programming system. Using one of the Philco subroutines, a 100 x 100 matrix inversion involving a million multiplications and a million additions can be performed by the 2000 in 50 seconds. A 40 x 40 matrix can be inverted in 3.2 seconds.

Circle no. 53 on reader service card.

TAPE PUNCH/VERIFIER

A modified IBM card punch keyboard is used in Systematics' D875 paper tape punch/verifier. To the IBM keyboard, Systematics has added six combination push button-signal lights, an eight-position lamp display, and a digital counter.

In addition to the alphanumeric keyboard, the D875 consists of a paper tape punch, a paper tape reader, and control circuitry. The machine operates in four modes:

1. punching from keystroke to tape;
2. punching some data from keystrokes, and duplicating other data from a tape loop in the tape reader;
3. verifying a previously punched tape by comparing the tape with keystrokes, simultaneously producing a new, verified tape; or
4. performing automatic duplication from tape reader to tape punch.

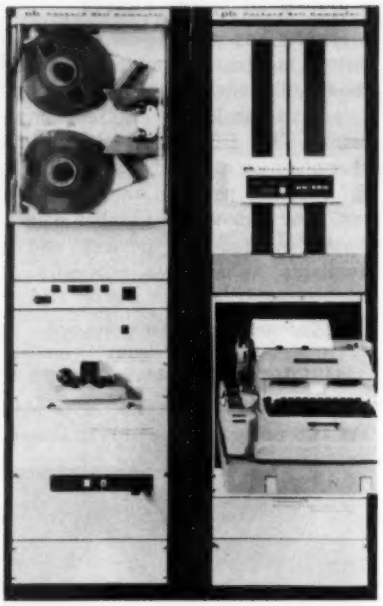
Capable of punching and verifying any code structure, with 5, 6, 7 or 8 channel tape, the D875 is available from Systematics on a 90 day order cycle.

Circle no. 54 on reader service card.

PB250 PERIPHERAL EQUIPMENT

A line of peripheral equipment for the PB250 computer is available from Packard Bell Computer Corporation, a division of Packard Bell Electronics. All of the peripheral units are designed for plug-in connection to the PB250 without need for accessory equipment or modification.

Included in the new line are magnetic tape units, a buffer, paper tape reader, paper tape punch, card reader, digital graph recorder, analog to digital and digital to analog converters, line printers, and a battery power supply. In addition a memory



Illustrating the capabilities possible in a compact package, the PB250 is shown in its rack mounted form with battery power supply; magnetic tape unit; high speed paper tape reader; high speed paper tape punch; and input/output Friden Flexowriter. Integral storage capacity within the computer in this form is over 4,000 words; a reel of magnetic tape will store up to 1,280,000 words.

extension unit can be supplied for increasing the storage capacity of the computer from a basic 2,320 to nearly 16,000 words.

Two types of magnetic tape units are available, up to six of which can be connected to the PB250 simultaneously. One unit, Model MTU-1, operates at 10 and 60 inches per second. Model MTU-2 operates at 75 inches per second with automatic tape search capabilities.

Circle no. 55 on reader service card.

INFORMATION RETRIEVAL

Speed of operation and flexibility of use are two features of new automatic information retrieval equipment announced by Jonker Business Machines, Inc. A new input machine for Jonker's Termatrex search system allows a keyboard operator to insert data into term cards three times faster than previously, and will also be able to receive data from conventional punched cards, paper tape, and magnetic tape. New output equipment is in the development stage.

Circle no. 56 on reader service card.

SOURCE DATA RECORDER

A new Source Data Recorder, Model 109, available from Datanamics, Inc., Los Angeles, punches standard IBM cards or card sets at point-of-origin to provide input data for processing. By producing punched IBM cards as a by-product of remote or source transactions, the recorder eliminates the usual input-preparation steps of key punching, key verification, or optical scanning. The device accepts ten digits of numeric input from embossed and IBM-coded plastic cards, ten digits of semi-fixed coding, and up to twenty digits of variable data. Punching registration is automatically controlled.

Circle no. 57 on reader service card.

PIGGY-BACK WIRING AID

Tech Panel has a new piggy-back unit that can be installed on any self-contacting control panel cover. The unit makes 80 hubs available for external machine function changes. Pilot and co-selector pick-up, comparing entry, program start and other external changes are made with special connector wires. Internal connections from the control panel to the piggy-back hubs are made with standard self-contacting wires. The unit is priced at $25, including the special external wires and the cost of installation.

Circle no. 58 on reader service card.

FRIDEN TEACHES IDP

Friden, Inc. has undertaken a wide-range program of educating present and future customers in integrated data processing. In 1961 the customer's program will cover 81 courses of study, not including seminars which are custom-designed to fit the needs of particular companies. In 1960, there were over 20 such seminars conducted by special arrangement between the customer and the Friden Center — customers such as the Army, Navy, Air Force, steel companies, electronics firms, and others.

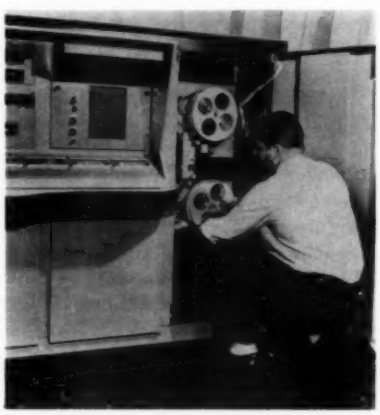
The program was first begun in 1957 in Rochester, N. Y. In addition to the original general data processing course, there are now programs in data communications, in-plant

data collecting and processing, systems design and flow-charting, cold type composition — graphic arts, Computyper programming — accounting, Flexowriter programming, add-punch programming, tape or card code converting, photo-listing, MICR methods, etc.

Most courses run five working days and have available over a million dollars worth of equipment with which to work. In addition to the full Friden line there are machines such as 80 and 90 column tape-to-card punches, spirit and offset duplicators, wire communications systems, and tape-operated stencil-cutting and plate-embossing machines.

Last year, over 2400 customers graduated from courses of study at the Center; they came from all parts of the continental United States, nine cities in Canada, Sweden, Hawaii, South America, Puerto Rico, England, and the Malay Peninsula.

Circle no. 56 on reader service card.



FILE SEARCH

FileSearch, developed by FMA, Inc., is able to retrieve stored information from microfilmed files at a high speed. The system stores 32,000 standard-sized magazine pages on a single roll of microfilm and can accommodate over 1,600,000 pages of information in a single file cabinet. When retrieval is necessary the machine automatically searches the microfilm reels at 6,400 pages a minute, making copies of requested material.

The system is composed of a recording unit and a retrieval unit. The recording unit photographs files of documents along with a description of each document's content which is coded in the form of opaque spots. These are stored together on reels of microfilm.

It is integrated into a single console, 71 x 55 x 50 inches, except for a recording camera and indexing machine. No associated units such as computers, card readers, etc., are required.

The facts requested from stored data on film are projected on the FileSearch screen for viewing; if permanent, usable records are desired, the machine produces immediate hard copy.

The system has a purchase price slightly over $100,000.

Circle no. 57 on reader service card.

LEASE OF CONTROL PANELS

Short-term leasing of control panels and wires is available from TCP Leasing Corporation, a new subsidiary of Tech Panel Company, Inc. Using local stock and facilities of Tech Panel's distribution system, the TCP plan will feature one to three year leasing, with provision for exchange of panels if the lessee should change equipment during the rental period. TCP quotes a rate of $1.88 a month for an IBM 407 panel leased for three years, not including local taxes.

Circle no. 58 on reader service card. ■

Single-piece construction of VPC Manual Plug wire completely eliminates tip or terminal breakage . . . cannot fall apart shorting machine. Two-way captive spring permits easy pull-out (exceeds IBM push-out requirements) yet provides strong-set lock. Nickel-plated Plug wire tip applied with patented "F" (bare wire) crimp prevents corrosion, assures maximum electrical performance. Millions in use.

VPC maintains complete inventory of all types wires for IBM Data Processing equipment. Immediate shipment.

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AUTHORS

(continued from page 4)

BRYSON CLARKE *(Insurance Accounting by RAMAC)* has been with the Kansas City Fire & Marine Insurance Company since 1940, starting as a punched card machine operator. He was appointed office manager in 1948, and in 1953 was promoted to assistant secretary.

Mr. Clarke served as vice president of the Fire & Casualty Midwest Chapter of the Insurance Accounting and Statistical Association 1959-60, and is currently serving his second term as director of publications, National Chapter of the IASA.

R. J. FITZPATRICK *(From Shadrach to Univac)* has been chairman of the accounting department since 1953 at Bellarmine College, Louisville, Kentucky. He was formerly associated with Lybrand, Ross Bros. & Montgomery, and Brown and Williamson Tobacco Corporation. He also served as vice consul at Caracas, Venezuela.

Mr. Fitzpatrick is a member of the American Institute of CPA's, American Accounting Association, Kentucky Society of CPA's, and the National Association of Accountants. He has had articles published in the *N.A.A. Bulletin, The Kentucky Accountant, American Speech, The Controller* and the *Journal of Machine Accounting.*

HENRY H. KRUEGER *(Reports for Modern Management)* is a methods analyst for Esso Standard, a division of Humble Oil & Refining Company. His educational background includes degrees of bachelor of science and master of business education.

WALTER E. PROEBSTER *(Thin Magnetic Film Memories)* is project manager in charge of research on switching circuits and magnetic thin film devices at the International Business Machines Research Laboratory, Zurich, Switzerland. Before joining IBM he was associated with the department of electrical communications at the Institute of Technology, Munich, charged with the development of the electronic circuits for the PERM computer. He has his Ph.D. in electrical engineering and holds membership in a number of professional societies, including the American Institute of Radio Engineers and the Swiss Society of Automation.

EMERSON W. PUGH *(Thin Magnetic Film Memories)* is head of a research group responsible for research on ferromagnetic metals and thin magnetic films in the International Business Machines Research Center, Yorktown Heights, New York. Prior to joining IBM he was an assistant professor of Physics at Carnegie Institute of Technology where he co-authored an advanced undergraduate text in electricity and magnetism. He has his Ph.D. in physics and is a member of a number of professional and honorary societies, including American Physical Society, Tau Beta Pi, and Sigma Xi.

JOHN WATSON *(Programmer Selection Survey)* acquired his formal education at Taylor University, Boston University, and New York University. He received his B.S. degree in accounting from Boston University in 1957, and his M.B.A. degree in management from New York University in 1961. His thesis at New York University was entitled, "Selecting and Training Computer Programmers."

While attending Boston University Mr. Watson worked as a junior accountant in several CPA firms. Since 1957 he has been employed by The Bendix Corporation, Eclipse-Pioneer Division, working in the comptroller's department as an auditor, general accountant, cost accountant, systems and procedures analyst, and currently, as a programmer and systems analyst.

PEOPLE AND PLACES

PHILCO's computer division announces appointment of *Benjamin F. Cheydleur* to the engineering staff; *Mort Bramson* to senior sales representative (New York); and *Arthur W. Carroll, Jr.*, manager of the new technical sales section of the marketing division.

PRESTOSEAL MANUFACTURING has appointed *Walcott-Taylor Company* of Washington, D.C. as dealers for their line of splicing machines for paper, magnetic tapes and film and microfilm. In Cambridge the new dealer appointed is *Paul B. Williams, Inc.*

LITTON INDUSTRIES has a new director of planning in *William J. Conner* and a new member of the corporate public relations and advertising staff in *John A. Duvall.*

NABAC named *Frank McCabe* editor of *Auditgram,* its monthly magazine.

PLANNING RESEARCH CORPORATION (Los Angeles) announced the appointment of *Jack C. Van Paddenburg* as manager of data processing.

RADIO CORPORATION OF AMERICA announces some new personnel movements: *Adrian C. Bos,* manager, data processing systems marketing, West Coast Missile & Surface Radar; *Stephen Mucha,* graphic art products department; *Frank L. Aldridge,* manager, customer systems acceptance, Palm Beach Center; *Manuel E. Haskins, Jr.,* manager, management science, EDP Division; *John J. Kramer,* manager, commercial sales; *Robert M. Gordon,* manager, training and education, EDP division.

SYSTEM DEVELOPMENT CORPORATION has named two new vice presidents — *Theodor H. Braun* and *Dr. Launor F. Carter.*

UNIVAC appointed *James P. Boyle* manager of data processing services.

THE STANDARD REGISTER COMPANY announced some new appointments: *R. L. Fortune,* assistant general manager; *E. C. Bates,* manager, eastern division; *L. F. Minnick,* assistant director of employee relations; and *F. E. Shelton, Jr.,* director of administrative services.

DR. HARRY HUSKEY, University of California, president of the Association for Computing Machinery, addressed the June 20 meeting of the Metropolitan Detroit chapter, ACM, at the University of Michigan, Ann Arbor. Trends in computer design and use noted by Dr. Huskey included calculation speeds, already increased over 1940 speeds by 1 x 10^6, which should go to 1 x 10^{12} by 1980; memory component size, which through use of cryotons and triodes should approach the size/capacity ratio of the human brain in 10 to 20 years; and memory capacity, which in the future computers may be on the order of 10^{14} bits, the equivalent of all books printed in the United States last year. Increased use of real time systems in the U. S., according to Dr. Huskey, will make it necessary to adopt a method developed abroad whereby direct relocation is possible without any relocation set-up run. ■

DATA . . . yours for the asking

THE AMERICAN UNIVERSITY will supply brochures and programs to persons interested in its Eighth Institute on Electronics in Management, to be held on the Washington, D. C. campus, October 30 - November 3, 1961.

Circle no. 70 on reader service card.

ADAPSO (Association of Data Processing Service Organizations) now has available its proceedings for the first Management Symposium ($5 to non members); also a directory of service centers which is free to potential users.

Circle no. 71 on reader service card.

ANKEN CHEMICAL & FILM CORPORATION offers a 24 page catalog and price list of its papers, films, emulsions, processors, and chemicals.

Circle no. 72 on reader service card.

BENDIX COMPUTER DIVISION has a one page brochure describing its DC-11 Data Communicator, an accessory to the G-20 computer.

Circle no. 73 on reader service card.

CUMMINS-CHICAGO offers a new revised booklet which details time and cost comparison of conventional and automated installment payment systems.

Circle no. 74 on reader service card.

FRIDEN has issued a 32 page booklet about the growing machine tool-numerical control field, defining use of numerical control and use of punched tape in the process.

Circle no. 75 on reader service card.

RESE ENGINEERING, INC. compiled a technical bulletin describing the Model 2032 Memory System Exerciser, an automatic high speed digital computer simulator that tests and evaluates complete memory systems over a wide range of operating parameters. Described in detail are the four main functional sections: timing generations, word generation, address generation, and word register and error detection.

Circle no. 76 on reader service card.

TAB PRODUCTS COMPANY has issued a four page brochure of techniques for the Spacefinder filing system in unit filers for ease of filing, locating, handling, etc.

Circle no. 77 on reader service card.

ISR DIVISION OF FMA, INC., has a 12 page brochure which outlines the operating technique of the ISR division — a group devoted to consultation and system development in information handling, storage and retrieval.

Circle no. 78 on reader service card.

VICTOR ADDING MACHINE COMPANY's six page brochure details solenoid operated digital printers, calculators, and tape punches for high speed serial or parallel entry. It illustrates alphanumeric printout for sequential item counting, variable input accumulations, test and inspection recording, and explains use for data accumulation from remote locations.

Circle no. 79 on reader service card.

(continued on next page)

HUGE SAVINGS
in Production, Inventory, or Sales Data Collection!

INFOCORDER
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Now, an operator can accurately record several thousand production, inventory, or sales data entries, or a complete route list of meter readings, on a single magnetic tape in this simple-to-use, 3½-pound recorder.

The INFOCORDER R-1 magnetic tape cartridge is then inserted in a P-1 Playback Unit for automatic entry in your data processing system (any common type of digital computer, punched cards and tape or computer magnetic tape units). Intermediate processing labor and costs are eliminated; save on storage . . . retain tapes for necessary period, then erase and reuse. FAST . . . INFOCORDER tapes may be played back at the rate of 6,000 individual readings per minute; whereas "sensing" type cards are processed at the slow pace of approximately 120 per minute.

The INFOCORDER system employs all-transistorized electronics; reliable coded digital recording interlocked to prevent improper operation; direct decimal data entry; detachable printed paper tape for recording program or "route list"; and playback compatible with all data processing systems. The R-1 Recorder and P-1 Playback units combine absolute reliability with exceptionally low initial cost and rapid "payout."

For complete information, please contact

INFOTRONICS CORP
1401 S. Post Oak Road
Houston 27, Texas

Circle no. 17 on reader service card.

(continued from page 34)

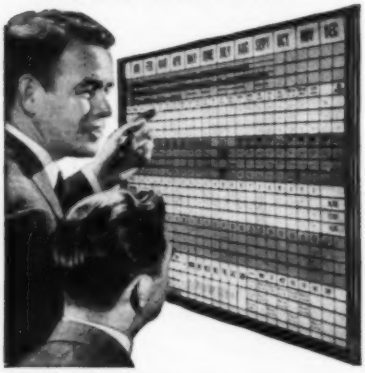
rather than on tape. The number of tape sorts required may be significantly reduced.

Probably the greatest overall impact of the 1301 will be in the lift it gives to the *total system* concept. The systems man must visualize this tool as much more than a storage unit for a computer. He must assess its potential based on a reexamination of the existing information systems in his organization. The real advantages of the 1301, indeed of computer systems, lie in the new concepts and approaches that emerge, rather than in a pure and simple speed-up of existing procedures.

This writer is of the school that believes random access processing is the best method evolved to date. As cost per unit of storage goes down, as storage capacity goes up, and access time declines, it seems inevitable but that some form of random access medium will become the prime mode of data storage and retrieval.

Accordingly, the 1301 is welcomed as one of the forerunners of the "ultimate" in data processing. ■

How To Get Things Done Better and Faster



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BOOK SHELF

ERROR-CORRECTING CODES by W. W. Peterson. Published jointly by The M.I.T. Press and John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 285 pages. $7.75.

Although this book primarily discusses error-correcting codes it also goes into error detection and correction.

After stating the coding problems, in conjunction with binary code transmission, the techniques and capabilities of linear codes are presented. Major linear codes are explained. Other codes and corrective and decoding methods are explained.

Most error detection and correction codes in a data communications system concentrate on conditions of each symbol. The broader problem deals with errors occurring in bursts.

Codes for correcting errors in "bursts" are required, and some of these codes are explained in Chapters 10 and 12.

The book is addressed to engineers. Although mathematics for understanding the theory presented are included, the reader should have a familiarity with modern algebra.

DAILY OPERATION OF THE COMPUTER ROOM. Automation Committee Report No. 3. Life Office Management Association, 110 East 42nd St., New York 17, N. Y. May, 1961. 26 pages.

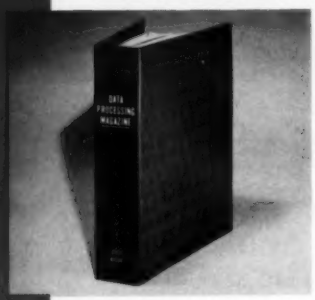
Written by and for computer personnel in the insurance industry, this short report provides an excellent and comprehensive view of the functions of a computer room in an electronic data processing installation. The report deals with four topics: scheduling, including time estimates, priorities, and backup equipment arrangements; utilization records for the computer and for auxiliary equipment; console operation, including computer room organization and control over computer use, check sheets, instruction sheets, logs, programmed and unprogrammed halts, and testing; and the tape library, including duties of the librarian, storage, handling, transportation and identification of tapes, and control over tape usage. The value of this report is not restricted to those in the insurance field.

AN INTRODUCTION TO ELECTRONIC DATA PROCESSING FOR BUSINESS by Leonard W. Hein. D. Van Nostrand Company, Inc., 120 Alexander St., Princeton, N. J. March, 1961. 320 pages. $9.00.

While use of the obsolescent IBM 650, as the machine by which programming is explained, may tend to make parts of this book outdated, it is still a very good basic text for undergraduates who might be enrolled in their first course dealing with business computers. Like other texts of its kind, the book develops basic concepts of both data processing and computers, describes the organization of an illustrative machine (the 650), and provides instruction in the use of the computer's operation codes, both apart from and as parts of problem examples. The use of payroll and inventory control problems is also in line with other introductory texts in this subject area.

The latter part of the book contains interesting chapters on variable and fixed length record maintenance and on merging, sorting and report writing with the computer. Each of the book's chapters ends with a set of discussion questions and a set of problems. There are four appendices: three of them are programming references for the 650, the other is a listing of the Greek alphabet. An index follows the last appendix. As the author states in his preface, "This book decidedly is not a reference book." ■

DATA PROCESSING BINDERS



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Circle no. 19 on reader service card.

editorial

SYMBOLIC LOGIC or A Programmer's Dilemma

AMONG THE MANY ITEMS OF INTEREST to those in the data processing field that cross the editor's desk, the following two pieces of symbolic logic are prize examples. Both are of rather ancient vintage (UNIVAC 1950) and may be familiar to many computer people. It is with some trepidation that we herewith repeat them.

No kitten that loves fish is unteachable.
No kitten without a tail will play with a gorilla.
Kittens with whiskers always love fish.
No teachable kitten has green eyes.
No kittens have tails unless they have whiskers.

One, and only one, deduction can be drawn from this set of statements. After considerable trial and error you may find the answer by rewording and rearranging the statements:

Green-eyed kittens cannot be taught.
Kittens that cannot be taught do not love fish.
Kittens that do not love fish have no whiskers.
Kittens that have no whiskers have no tails.
Kittens that have no tails will not play with a gorilla.

The only valid deduction, then, is that green-eyed kittens will not play with a gorilla.

If a mathematician does not have to wait 20 minutes for a bus, then he either likes Mozart in the morning or whisky at night, but not both.

If a man likes whisky at night, then he either likes Mozart in the morning and does not have to wait 20 minutes for a bus or he does not like Mozart in the morning and has to wait 20 minutes for a bus or else he is no mathematician.

If a man likes Mozart in the morning and does not have to wait 20 minutes for a bus, then he likes whisky at night.

If a mathematician likes Mozart in the morning, he either likes whisky at night or has to wait 20 minutes for a bus; conversely, if he likes whisky at night and has to wait 20 minutes for a bus, he is a mathematician – if he likes Mozart in the morning.

When must a mathematician wait 20 minutes for a bus?

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